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	Page
Possibilities of Further Expansion of Fish and Prawn Cultural Practices in India—N. Kesava Panikkar	29
Symposium on Cybernetics	33
Sulphur from Sea Water	34
The Genetical Behaviour of Sclerostachya × Narenga Hybrids and Their Back-Crosses—T. S. Raghavan ..	35
International Computation Centre ..	36
Letters to the Editor	37
Reviews	53
Science Notes and News	58

POSSIBILITIES OF FURTHER EXPANSION OF FISH AND PRAWN CULTURAL PRACTICES IN INDIA

ONE of the geographical peculiarities of India lies in the existence of vast low-lying areas along the entire coastline both on the East and West Coasts, although they tend to occur more extensively on the East Coast. As these areas are saline they are unfit for agricultural purposes. Soon after the monsoons these get inundated with a few feet of rain water and in addition, tidal water often comes in from the sea, either trickling over the sand bars or through temporary connections established with the sea during the monsoon months. The water in them is invariably saline, but the salinity is subject to a great deal of fluctuation from about 5 to 50 parts per mille, the higher values being observed during the summer months. Towards the end of summer the salinity further increases; patches of water get isolated and the shallower ones dry up; some of the remaining deeper pools contain waters so highly saline as not to support any appreciable amount of life with the exception of halophilic blue green algæ and bacteria. These extreme conditions of drought are not observed on the West Coast which is served by both the South-West and North-East Monsoons.

It is obvious that if these areas can be developed so as to be available for food production they would make a substantial contribution to the food resources of the country. A good proportion of them is capable of being developed into marine fish farms of the type found in some parts of Italy and Southern France for the cultivation of marine fish, principally mullets. The suggestion was first made by Hornell,[1] but no active steps have been hitherto taken; most species which he considered suitable cannot now be recommended for culture. Fortunately, we are not lacking in other suitable species since many of the mullets (*Mugil* spp.) and the milk-fish (*Chanos chanos*) found on the Indian Coast can withstand wide salinity changes.[2] Physiologically, what would be ideal are species which prefer low salinities in their younger stages and as growth proceeds, prefer progressively higher salinities. Species chosen

for fish cultural purposes should in addition be such as would benefit from the primary food cycle of waters or, in other words, should be algal, vegetable or detritus feeders so that they will not have to be dependent on other animals for food. Many of these advantages are combined in *Chanos chanos*, the fry of which appear in considerable numbers in certain parts of the Indian Coast, particularly in the Pamban area in the months April-June. As *Chanos* fry can be stocked in inland waters and grown to marketable size, there is urgent need to expand the fry resources by locating more centres from where the fry could be secured. At the present time the supply is much less than the demand. The available information on the occurrence of *Chanos* fish-seed in S. India has been recently summarized.[3] The main season for fry is during the drought period but this drawback will cease if an auxiliary season is generally prevalent as has been recently suspected.[4]

For the proper utilization of the coastal shallow tracts for *Chanos* or mullet culture, permanent reservoirs of water should be formed by excavation, bunding and by the provision of sluice gates connecting them through feeder canals with the sea so that water could be allowed in as required. The coastal tracts are extensively developed into salt-water ponds or 'tambaks' in Indonesia where *Bandœng* or *Chanos* culture has been developed into a highly specialised fish cultural practice.[3,4] Where tides are not strong, pumping devices are employed in that country. So far as India is concerned, development of marine fish farms is a distinct possibility which should be explored by carrying out preliminary trials in selected areas. Rao[7] has estimated the available area for this purpose at 2,000 square miles and has computed an annual production of about 500 lb. per acre at an estimated initial cost of Rs. 10,000 per square mile; it is clear that fish production even at half the above figures per acre would be a major contribution to the annual fish-yield of the country. The problem is, however, the combination of tidal amplitude and sea level with the lay-out of the farms and, unfortunately, the tidal range is rather small in most of the open coasts of South India. Inexpensive pumping devices have to be worked out for such areas. In places where natural connections with the sea exist for these saline lagoons or where small streams open into the sea, it is observed that such areas have a rich fauna and flora both in numbers and species, contributing to the brackish-water or estuarine biotope.[1] Similarly, in sheltered areas along the coast there is a rich marine fauna; very productive fisheries exist in the saline coastal lakes of Chilka and Pulicat. These factors would probably indicate that coastal fish ponds, if developed, would likewise develop a rich flora and fauna and also offer possibilities of enriching these waters by organic manures. The employment of chemical fertilizers will probably be beyond our means until their production in the country has made substantial progress.

The question naturally arises whether we could make better use of these areas than is now done without much expenditure for developing them into artificial marine fish farms. If the area is to be used for growing fish, we should require species which would grow to marketable size within 3 or 4 months, for that is all the really reliable period when water is available, and whose fry could be obtained on the coast in large numbers for stocking purposes. No such species at present seems to exist which would give reasonable harvest in so short a time, but there is need for much closer study on the subject. *Trichogaster pectoralis* (Regan) which grows to a length of 8 inches in 10 months' time[8] is probably suitable for areas where water is retained for longer periods, but it is known to be suitable only for waters of solinity less than 10 parts per mille. Similarly, it would appear that *Tilapia mossambica* Peters which was introduced into Malaya by the Japanese during the World War II might be another successful species. Both are not found in India and have to be introduced, but we are now not in a position to recommend the introduction of these species without ruling out the indigenous species, and without making sure that these species are not likely to affect the local ecological conditions and cause adverse effects. However, since both these species are non-predators, the danger to the autochthonous fauna is not great. The short duration available for growth, and the fact that both these species prefer waters of lower than higher salinities introduce serious handicaps in their selection for the utilization of marine coastal belts. The question of introduction of *Tilapia mossambica* deserves close study and it is necessary to formulate a national policy as to whether this species should be kept out of India, or its introduction actively encouraged. Being a hardy and euryhaline species with a comparatively high rate of reproduction, mouth breeding and with intermittent spawning seasons, it may be fairly

certain that, once introduced, the species would become permanently established as it has in many places in the Far East. Our indigenous species which might be affected are probably the fishes belonging to the same family Cichlidæ in India, *viz., Etroplus maculatus* (Bloch) and the Pearl Spot *Etroplus suratensis* (Bloch). The latter is a highly esteemed fish thriving in the back-waters and adjoining brackish tracts of the S.-W. Coast of India and in smaller numbers in some of the coastal districts of the E. Coast and steps have been taken by the State Fishery Department of Travancore-Cochin and Madras to popularize its culture. The fish is a nest builder and the rate of reproduction is discouraging for its selection as a species for large-scale culture. There has been a most marked depletion of the fisheries in the back-waters, canals and low-lying areas in Travancore during the past ten years, owing probably to the intensive fishing which has been going on without replenishment having taken place. Many areas which formerly used to yield appreciable numbers of *Etroplus* have ceased to be so. Although the probability exists that the fertility of the waters might have gone down in recent years, it is difficult to overlook that large amounts of organic food is still available in these waters especially after the first few rains. Under such circumstances the introduction of omnivorous feeders which can tolerate wide variations in salinity and which can reproduce more rapidly than *Etroplus* and establish as permanent species is an obvious suggestion. For raising a profitable crop of fish in the large numbers of small perennial ponds in the low-lying areas of the West Coast of India, there is also need for fish that would breed in the small volumes of water. *Tilapia mossambica* can successfully establish in closed waters and satisfies most of the requirements of salt-water fish culture.[9,10] However difficult it be for most zoologists to view the introduction of exotic species with equanimity, the question deserves close study.

It is well known that unchecked activity of predator species has in many areas been the cause of depletion of fisheries and no organized attempt has yet been made in many parts of India to remove and exterminate predators. It is also not realized that carnivorous species are best removed from small-scale fish ponds. On the other hand if they are cultured, the need for animal intermediaries in the food cycle of these species is not fully appreciated and provision is not made for the growth of species which would serve as food for the carnivorous forms. The author has come across large numbers of perennial ponds in Travancore which support a rich plant life, but as regards fish fauna they contain nothing except occasional *Ophiocephalus* and many ponds of brackish water on the fringes of saline tracts, although rich in algæ, often contain little or no useful fish life. The need for hardy and quickly establishing crustacea valuable as food to other fishes is necessary in these waters. There is already one indigenous mysid which is found in the back-waters and estuaries of the East and West Coasts of India, *viz., Mesopodopsis* = *Macropsis orientalis* Tattersal which can be successfully spread by transplantation and can be cultured; it is a most hardy salt-water species capable of life in waters nearly fresh[11] and is consumed as food by most estuarine species.

Oyster culture is another line of utilization, but the people of this country have not yet taken a liking to this highly nutritive form of food, so that large-scale development of oyster farms cannot be recommended at this stage.

There is, however, a source of marine life which appears to be capable of more extensive utilization and offers scope for extended cultural practices. The prawns belonging to the family Penæidæ are extensively distributed in our seas and contribute to most valuable fisheries.[12,13] They are accepted as food by a majority of our people; they support a large volume of profitable export trade and fresh or frozen prawns are beginning to provide the basis of a luxury trade. The principal genera involved are *Penæus, Metapenæus* (= *Penæopsis*) and *Parapenæopsis*. The last-mentioned is mainly a marine genus, but species of *Penæus* and *Metapenæus* occur on the coast as well as in the back-waters. It is now known from the work of several investigators that these prawns which hatch out as nauplii unlike many other marine Decapods come near the shore when they are very young and ascend back-waters and estuaries when they are of sizes varying from 10-20 mm. In the habit of their breeding only in the sea and coming on shore when young, they resemble *Chanos chanos*. As is natural, the earliest phase in the development of farming operations is the trapping of fry found on the coasts and rearing them in convenient natural enclosures. The prawn clutural practices developed on the coast of Travancore-Cochin are based on the simple procedure of trapping the post-larval and young penæids in the paddy fields adjoining

coastal canals where they have entered from the sea by allowing tidal waters freely to enter the fields during high tides and to have closely meshed nets placed at the entrances to the field when the water flows out.[13] Selection of species is not possible by this method, but advantage is taken of the habits of the post-larval penæids whose appearance in large numbers coincides with the bunding operations of the rice fields soon after the North-East Monsoon, the fields being thus used for prawn culture during the season when not required for rice cultivation. In Bengal, Hora and Nair[14] have indicated how the salt-water Bheries of the Sunderbans area could be further developed so as to yield better supplies of fish and prawns than they do at present.

Young Penæids are found in all the coastal waters of India during most parts of the year—more especially, during the season October to January. On the East Coast of India large numbers of them are seen in the months immediately following the North-East Monsoon in October-November. Young ones of *Penæus indicus* M. Ed. and *Metapenæus monoceros* (Fabr.) have been found in most parts of the East and West Coasts and it appears from their distribution in the Indo-Pacific area that the species can be expected in most coastal areas, especially where there are tidal creeks or mud flats. On the East Coast a less abundant form is *P. carinatus* Dana which grows to a larger size than the other two in the coastal areas. Many other species like *M. dobsoni* on the Malabar Coast and *M. brevicornis* in Bengal are abundant and already form valuable fisheries. Most coastal areas of the E. Coast are admirable centres for the collection of prawn fry. Judged from the available data as well as from the observations of Schuster[15] in Indonesia, it is obvious that the young prawns grow extremely rapidly and attain marketable sizes within short periods. Schuster mentions that in the tambaks around the island of Java and Madura the prawns attain marketable sizes, *P. indicus* and *M. monoceros* growing to a length of 10-15 cm. within a period of 4-6 weeks. This amount of growth is probably too good to be taken as the general rule. From the observations made by Menon (unpublished) at Madras and Malabar, by Sadasivan (unpublished) at Upputeru at the mouth of the Collair (Kolleru) Lake and at Pulicat and from the author's observations made on different occasions at Cochin, Veli Lake near Trivandrum, Madras, Ennore, Akividu on the Collair Lake and from collections seen from many other parts of India, the rate of growth of these species may be considered to be between 20-36 mm. within a month, the higher figures being applicable to prawns of very small size. High amounts of calcium are available in the saline lagoons which is beneficial to young prawns which frequently moult. As regards prawns of 40 mm. and above the rate of growth is probably less than above and with longer intermoult intervals as is usual in the Natantia. If the shallow coastal creeks and lagoons are stocked with prawns it is clear that they will be able to grow to utilizable sizes before these waters dry up, in the same manner as they do in areas where they enter during the spring tides. It appears, therefore, that further expansion of prawn cultural practices is definitely possible in India by collecting young post-larval penæid prawns from the coastal areas where they abound and by stocking them in coastal shallow lagoons and saline fish ponds into which the fry do not naturally enter. Elements of an unorganized fishery of this type already exist in some parts of the East Coast. Simple experimental observations which the author has made during the past few years indicate that prawn fry can be safely transported in earthenware containers and it should be quite possible also to utilize tin fish carriers.

There is, however, one great limitation in the extension of prawn cultural practices. Unlike *Chanos* the penæid prawns cannot be cultured in fresh water. They are, however, at home in waters of low salinities; *Metapenæus monoceros* is known to survive in waters of salinity as low as one to two parts per mille. *Penæus indicus* and other species on the other hand require considerably higher salinities, but low salinities are tolerated by the young ones of these species. What is noteworthy is that the penæids and, especially *Metapenæus monoceros*, show extraordinary powers of osmoregulation, achieved by the active regulation of chlorides in blood[16] indicating the same type of hypo-osmotic regulation as the palæmonid prawns[17] endowing them with an ability to thrive in salinity ranges not tolerated by most species and which, in fact, has considerably enhanced their value as culturable species.

Young penæids mostly remain buried in the mud with just their eyes and antennæ protruding and their food mainly consist of organic detritus found in the mud, algal material and other extremely small organisms contained in the mud. They are able to thrive in areas

devoid of much algal vegetation which is so necessary for *Chanos*. It may be added that the young prawns do not compete with *Chanos* for food and is hence widely employed subsidiary to *Chanos* culture in the Indonesian tambaks.[15] So far as the Indian Coast is concerned, what is required is an intensive collection and stocking of these penæids in the coastal waters which are otherwise unused by the successful combination of the principles of the prawn culture of the Malabar Coast and the *Chanos* culture of the Eastern countries.

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1. Hornell, J., *Madras Fisheries Bull.*, 1911, No. 6. 2. Panikkar, N. K., *Proc. Indo-Pacific Fish. Council*, 1951, **2**, 168-75. 3 Ganapati, S. V., Chacko, P. I., Srinivasan, R. and Krishnamurthy, B., *Ind. Geogr. Journ.*, 1951, **25**, 1-25. 4. Panikkar, N. K., Tampi, P. R. S., and Viswanathan, R., *Curr. Sci.*, 1951, **21**, 18 19. 5. Schuster, W. H., *De Viscultuse in de kustwijnen op Java. Landbouw Publ.*, 1949, **2**. 6. Hickling, C. F., *Nature, London*, 1948, **161**, 748-51. 7. Rao, H. S., *UNSCCUR Experience Paper*,—7/ Sect. W. 120. 6x, Marine Resources, 1949. 8. Schuster, W. H., *Ceylon Fisheries. Sessional Paper*, 1951, **24**, 1-15. 9. —, *Contr. Gen. Agr. Res. Stat. Bogor.*, 1950, **111**, 1-31. 10. Le Mare, D. W., *Proc. Indo-Pacific Fish. Council*, 1951, **2**, 180-83. 11. Tattersal, W. M., *Mem. Ind. Mus.* 1915, **5**, 149-61. 12. Chopra, B. N., *Proc. Address Sect. VI. Ind. Sci. Congress*, 1943, 1-21. 13. Panikkar, N. K., *Journ. Bombay Nat. Hist. Soc.*, 1937, **39**, 343-53. 14. Hora, S. L. and Nair, K. K., *Fish Dev. Pamphlet, Govt. of Bengal*, 1944, No. 1. 15. Schuster, W. H., *Landbouw, Buitenzorg*, 1948, **20**, 521-31. 16. Panikkar, N. K. and Viswanathan, R., *Nature, London*, 1948, **161**, 137. 17. —, *J. Mar. Biol. Assoc.*, 1941, **25**, 317-59.

SYMPOSIUM ON CYBERNETICS

A CHARACTERISTIC of the evolution of science in the present century has been the progressive intermingling of the various branches formerly considered as independent. This is especially true of the post-war years which have witnessed the emergence of the fascinating branch of study called cybernetics from the unification of the methodologies of the mathematical, physical and biological sciences. A Symposium on this subject was held on 31st January and 1st February, 1952, at the Indian Institute of Science, Bangalore. It was inaugurated by Prof. M. S. Thacker, Director of the Institute, who also presided over the Session the first day; Dr. J. Chandy of the Christian Medical College, Vellore, took the chair on the second day. The purpose of the Symposium was mainly to stimulate interest in the field and to have a discussion in which workers in different sciences could take part. With this in view, reports on the various aspects of cybernetics were invited from workers in mathematics, physics, engineering, neurology and psychology both in Bangalore and outside. The Symposium, the first of its kind in India on this new branch of science, was organised by the Bangalore Branch of the Association of Scientific Workers of India and its success was mainly due to the efforts of Dr. B. S. Ramakrishna, President, and Mr. N. N. Narayana Rao, Secretary of the Association. It is recognised that the greatest progress is likely to occur in those regions of science which are the meeting points of established subdivisions and symposia of this type should therefore act as a stimulus in furthering research in these borderlands.

In his inaugural address, M. S. Thacker pointed out that cybernetics, which considers the problems of control and communication in man and machine from a unified point of view, is a common field of investigation for scientists working in various fields. Thus, specialists in one field could place their intimate knowledge of their science at the service of other specialists and will in turn enrich their knowledge with what they can borrow from the others. On the practical side, cybernetics holds great promise to mankind, for instance, in the development of various devices which would help to replace one lost sense by another.

Opening the discussions, B. S. Madhava Rao dwelt on the scope of cybernetics and pointed out the fundamental role played by such diverse concepts as entropy in statistical mechanics and thermodynamics, feedback in engineering and even some aspects of mathematical logic in the terminology of cybernetics. The most important applications of cybernetics are in the field of neurology and rest on the hypothesis that the chief mechanism of the central nervous system is one of negative feed-back, which explains purposive and adaptive behaviour.

The next two papers dealt with information theory from the points of view of a communication engineer and a mathematician. B. S. Ramakrishna, who considered the former aspect,

discussed how the transmission of information can be studied quantitatively mainly as a result of the work of Wiener and Shannon. He indicated how the problem of communication through speech between one man and another can be discussed from this aspect and can thus become the object of study for acousticians, linguists, neurophysiologists and psychologists. V. R. Thiruvenkatachar's paper, which was presented by S. Dhawan, considered the time series nature of the messages transmitted in communication systems. It considered from the mathematical standpoint how best to recover a message which gets corrupted by noise during transmission and how to obtain an idea of the future of the message from the statistics of its past behaviour.

A set of three papers was concerned with the problem of feedback in men and machines and the manner in which they react to external stimuli. T. K. G. Menon and K. K. Nair dealt with the fundamental principles of feedback as met with in engineering, and pointed out how these could be applied to explain certain physiological phenomena. Such ideas may even be of possible use in explaining some aspects of social sciences. In the discussions which followed, Tischner indicated methods of determining the stability conditions of feedback systems. V. Narayana Rao spoke on the principles of mechanical servo-systems, their stability and their use in automatic tracking and remote control systems.

J. Chandy and B. Singh dealt with the cybernetic approach to the nervous system. The hypothesis that the mechanism here is analogous to the feed-back, scanning and servo-mechanisms met with in engineering is supported by the structure and function of neurones, Cajal's collateral and synapses. Proprioception, wakefulness and behaviour may thus be understood in terms of the above mechanisms occurring at various levels, i.e., spinal cord, brain stem, cerebellum, basal ganglia and the cerebral cortex. Epilepsies may be due to derangement in the feed-back and scanning processes.

P. Srinivasa Rao explained how the general principles of instrumentation in machines are also applicable equally well to the sense organs of the living body. The main difference is that sense organs yield a combination of the instantaneous value and its time rate of change. He pointed out that in its reaction to external stimuli, the human physical motor behaviour is very similar to a servo-mechanism. The similarity between the functioning of the human brain and the working of machines like the modern automatic calculators was discussed by G. N. Ramachandran. He gave a description of the manner in which these machines work without any intermediate human aid and how they can perform many aspects of what may normally be termed "thinking".

M. V. Govindaswamy, taking the psychologist's point of view, said that although the cybernetical approach helps one in understanding some aspects of neurophysiology, the analogy between the nervous system and the communication system of the engineer is far from exact. He was of the opinion that although machines may be made to work in a manner similar to human beings, whether this approach can ever explain man completely is rather doubtful. The same opinion was expressed by J. Chandy. He pointed out that one must not conclude from the machine analogy that all neural and mental processes are essentially electrical in nature. In fact, the transmission of neural impulses at the synapses appear to be determined by the effects of chemcal agents like enzymes.

Arrangements are being made to publish the full text of the papers presented at the Symposium.

SULPHUR FROM SEA WATER

ALMOST sixty years ago, the interest in marine chemistry was great enough to render the idea of biological reduction of sulphates familiar to a few. Work over three decades on esturial phenomena, Prof. Hugh Nicol claims,* have shown that hydrogen sulphide can be released from the sea to any desired extent. The engineering difficulties in collecting the evolved gas may be considerable but there seems to be no relevant biological or chemical problem that cannot be tackled by present techniques, and the production of sulphur from sea water may prove to be no exception.

* *Nature*, Nov. 24, 1951 p. 894.

THE GENETICAL BEHAVIOUR OF *SCLEROSTACHYA* × *NARENGA* HYBRIDS AND THEIR BACK-CROSSES

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SCLEROSTACHYA AND *NARENGA* have been found to play a part in the chromosomal constitution of *Saccharum officinarum*. Parthasarathy[1] found that the basic complement of $n = 10$ chromosomes of *officinarum*, is composed of 2 different chromosome complements $n = 5$ each and one of these is similar to 5 chromosomal complement of *Sclerostachya*. Raghavan[2] found that these five chromosomes bore homology to 5 chromosomes of *Narenga* also. The homology of the second set of 5 chromosomes has yet to be ascertained. Thus *Sclerostachya* and *Narenga* appear to be very closely related genetically. The hybrids between these two genera show complete allo-syndesis;[3] nor is there any reciprocal non-identity suggestive of cytoplasmic inheritance. A few characters were chosen for study in these hybrids and back-crosses with their parents. These reveal a few interesting features which are presented in this short paper. The presence of circlet of hairs at the nodes of the flowering culms (*Narenga* character) is dominant over its absence. The occurrence of pedicelled and sessile spikelets (*Narenga* character) is also dominant over its absence (*Sclerostachya*). The absence of hairs on the upper surface of the leaves (*Sclerostachya* character) is dominant over its presence (*Narenga* character). In the matter of the presence of nodal buds in the flowering culms (*Narenga* character), its absence (*Sclerostachya*) is dominant. Table I gives the number of plants examined in regard to these characters and the observations made. It will be seen that except in the character of hairs on the upper surface of leaves, the deviation from expectation is not significant in respect of the other characters. Also the selfed progenies show no appreciable segregation and as such it may be assumed that these are fairly homozygous for most of the characters.

When back-crossed to the respective parents, the following observations were made: In characters like the circlet of hairs, occurrence of pedicelled and sessile spikelets whose presence in *Narenga* is dominant, the back-crossed progeny with the parents would appear to show the

TABLE I

Characters	*Narenga*	*Sclerostachya*	*Narenga* × *Sclerostachya*	*Sclerostachya* × *Narenga*
Circlet of hairs ..	+	−	+142 − 5	+105 − 3
Hairs on upper surface of leaves	+	−	+24 −84	+ 37 −110
Spikelets Pedicelled & Sessile (PS); Both Pedicelled (PP)	PS	PP	PS=47 PP= 1	PS=44 PP= 1
Nodal buds	+	−	− 9	− 9

TABLE II

Parents		Circlet of hairs*	Spikelets †	Hairs on upper surface‡	Nodal buds§
Female	Male				
P' 567/3 (*Narenga* × *Sclerostachya*)	*Narenga*	+26 − 1	PS=27 PP= 0	+27 − 0	+26 − 1
P' 567/3	*Sclero-stachya*	+ 4 − 4	PS= 4 PP= 4	− 8 + 0	− 8 + 0
P' 567/3 (Self)		No survivals			
P' 568/1 (*Sclero-stachya* × *Narenga*)	*Narenga*	+ 8 − 0	PS= 8 PP= 0	+ 8 − 0	+ 8 − 0
P' 568/1	*Sclero-stachya*	+ 2 − 2	PS= 2 PP= 2	− 4 + 0	− 4 + 0
P' 568/1 (Self)		No survivals			
Ikra	..	+24 − 0	PS=24 PP= 0	+ 2 −22	+ 2 −22
Ikra	*Narenga*	+14 − 0	PS=14 PP= 0	+12 − 2	+12 − 2
Ikra	*Sclero-stachya*	+ 5 − 4	PS= 5 PP= 4	+ 2 − 7	− 8 + 1
Ikra (Self)		+13 − 5	PS=12 PP= 6	+ 7 −11	+13 − 5

* + Present (*Narenga* dominant); − Absent (*Sclerostachya* recessive). † PS = Pedicelled & sessile (*Narenga* dominant); PP = Both pedicelled (*Sclerostachya* recessive). ‡ + Present (*Narenga* recessive); − Absent (*Sclerostachya* dominant). § + Present (*Narenga* recessive); − Absent (*Sclerostachya* dominatn).

expected ratio, i.e., with the recessive parent, namely, *Sclerostachya*, we get the 1 : 1 roughly, while with the dominant parent, namely, *Narenga*, all the forms show the character in question. However, in characters like nodal buds in the flowering culms and hairs on the upper surface of leaf whose presence (*Narenga*) is recessive to their absence (*Sclerostachya*), the back-crossed progeny show this interesting feature. When back-crossed to dominant parent (*Sclerostachya*) all show absence of these characters which is as it should be. But when back-crossed to the recessive parent (*Narenga*), instead of the expected 1 : 1, all show the recessive character. It must, however, be admitted that the number of progeny available in these back-crosses is very limited and as such are not capable of statistical analysis. Even so it seems that in back-crosses with *Narenga* the deviation from expectation is highly significant only in respect of characters which are recessive in *Narenga*. Also it was noticed that survivals in these back-crosses are not very high and so far as selfed progeny of F_1's are concerned, there has been practically no survivals. Hence it has not been possible to study the behaviour of these characters in the F_2 population. Even so, it looks as if *Narenga* as the male parent exercises some influence in this matter, even though the character in question is recessive. It remains to be seen what the behaviour will be if *Narenga* and *Sclerostachya* are used as females and the F_1 hybrids as male. It may also be mentioned that the pollen fertility of the F_1's in either direction is well over 90 per cent. Why there are no survivals in the selfed progeny of these F_1's is not yet clear.

The expression of the characters mentioned above was studied in *Ikra* also. It was found that the genetical behaviour of *Ikra* is such as to confirm the belief that it is a natural hybrid between *Narenga* and *Sclerostachya*.[3] In other words, circlet of hairs was found to be present in the nodes of the flowering culm. Nodal buds were found to be absent in the nodes of the flowering culm. They were found to possess pedicelled and sessile spikelets, obviously the expression of dominance of *Narenga* character. In back-crosses with *Sclerostachya* and *Narenga*, the behaviour was also found to be the same, as if *Ikra* was the F_1 hybrid between the two genera, and the interesting feature is that in back-crosses to *Narenga* in which the presence of some *Narenga* characters like nodal buds and hairs on upper surface, is recessive to their absence, all showed the recessive character instead of the expected 1 : 1. This uniform behaviour of these back-crosses involving *Narenga* as the male parent both in *Ikra* as well as artificial hybrids of *Sclerostachya* and *Narenga* is something which is worthy of note.

Table II gives in an analytical manner the expression of the characters in *Ikra* and in the back-crossed progeny available for observation

1. Parthasarathy, N., *Nature*, 1948, **161**, 211. 2. Raghavan, T. S., *Journal of Heredity*, 1951, **42**, 599. 3 Parthasarathy, N. and Subba Rao, K. S., *Proc. Ind. Sci. Cong.*, 1947.

INTERNATIONAL COMPUTATION CENTRE

THE Convention for the setting up of an International Computation Centre was signed at Paris on 6th December, 1951, by Belgium, Egypt, Iraq, Israel, Italy, Japan, Mexico and Turkey.

The Centre is to be in Rome, where the Italian Government has offered a wing of its National Research Council Building. It also has agreed to lend the Centre $ 75,000 without interest for ten years. All the library and documentation facilities of the National Research Council will be at the disposal of the Centre.

The Centre's annual budget is expected to amount to about $ 100,000, which will be made up from the contributions of its member states. For the first year, UNESCO will give the Centre a $ 15,000 grant and a loan of $ 60,000.

LETTERS TO THE EDITOR

PAGE

Electronic Transitions in the Complex Band Spectrum of Nickel Chloride—V. G. KRISHNAMURTY 37

Preparation of 1-Amino-4-hydroxyanthraquinone—N. APPALA RAJU, M. KANTHARAJ ARS AND K. NEELAKANTAM 38

Occurrence of Detrital Kyanite, Andalusite and Garnet in the Gulcheru and Pulivendla Quartzites—C. GUNDU RAO 38

Fabrication of Aluminium Bronze by Powder Metallurgy Method—A. GUPTA 39

The Seeds of Walkomiella *indica—A Conifer from the Lower Gondwanas of India*—K. R. SURANGE AND PREM SINGH 40

Charophyte Remains from the Jurassic of Rajmahal Hills, Behar—VISHNU MITTRE 41

Manganese Micas from a Pegmatite in India—S. A. BILGRAMI 42

Phagocytic Co-efficients of Certain Indigenous Medicinal Plant Extracts—RAJUL BROKER AND J. V. BHAT .. 43

Quantitative Determination of Amino Acids Separated by Circular Paper Chromatography—K. V. GIRI, K. KRISHNAMURTHY AND T. A. VENKATASUBRAMANIAN 44

PAGE

A Direct Volumetric Procedure for Estimation of Thorium—P. VENKATESWARLU AND A. N. RAMANATHAN 45

Mutual Supplementation in Vegetable Proteins—B. M. LAL AND R. RAJAGOPALAN 45

Alkaloidal Constituents of Withania somnifera—D. N. MAJUMDAR 46

Biological Standardisation of Digitalis Using Dogs—V. RAMAMURTHY, A. S. RAMASWAMY AND N. N. DE 47

Ring Disease of Potato in India—M. K. PATEL, N. B. KULKARNI AND Y. S. KULKARNI 47

Vernalization of Peas—N. N. DIKSHIT .. 48

Occurrence of Persistent Pollen Tubes in Malvaceæ—C. VENKATA RAO 49

Raw-Rice Washings—A Source for Cane Growth Factors—M. VIJAYASARADHY .. 50

Arsenophosphotungstic Acid—A Microreagent for Cerium—G. S. DESHMUKH 50

Regional Water Content of the Intestinal Wall of Earthworms and Its Significance—B. K. TANDON 51

A Colour Reaction for Chloromycetin—K. L. ARORA AND C. R. KRISHNA MURTI 52

ELECTRONIC TRANSITIONS IN THE COMPLEX BAND SPECTRUM OF NICKEL CHLORIDE

FOLLOWING the work on the band spectrum of nickel chloride reported previously,[1] it is found that the complexity in the structure of the bands arises from (1) an overlapping of different systems, and (2) the existence of high multiplicity electronic terms. The bands have been regrouped into five systems now designated as A, B, C, D and E of which C and D are the same as the systems 1 and 7 mentioned previously. The systems involve doublet and quartet terms.

The following Table gives the electronic transitions, the wave-numbers of the Q heads and the vibrational constants obtained in systems A, B and E.

System ..	A	B	E
Electronic Transition	$^4\Pi - {}^4\Sigma$	$^4\pi - {}^4\Sigma$	$^2\pi - {}^4\Sigma$
Q_4 ..	24305·7 cm.$^{-1}$	23247·1 cm.$^{-1}$	..
Q_3 ..	24185·6	23152·9	..
Q_2 ..	24064·1	23049·4	21688·2 cm.$^{-1}$
Q_1 ..	23936·8	22946·7	21585·3
ω_e' ..	400·9	398·0	400·1
ω_e'' ..	416·3	416·2	414·5

Systems A, B and E have a common lower state.

The (0, 0) sequence of system C presents double-headed bands of equal intensity. The system is assigned to a $^2\Sigma - {}^2\Sigma$ electronic transition; the band heads are represented by

$$\nu = 22749{\cdot}2 + 398{\cdot}9\,u' - 1{\cdot}03u'^2 - 421{\cdot}5\,u'' + 0{\cdot}51u''^2$$

The vibrational formula for the band heads of the D system (also assigned as a $^2\Sigma - {}^2\Sigma$ transition) is

$$\nu = 21920{\cdot}5 + 404{\cdot}4\,u' - 1{\cdot}16u'^2 - 422{\cdot}5\,u'' + 0{\cdot}25\,u''^2$$

Of the observed different lower states $^4\Sigma$ and $^2\Sigma$, it is not clear which is the ground state; probably both are low lying levels.

Full details will be published elsewhere.

Dept. of Physics, V. G. KRISHNAMURTY.
Andhra University,
Waltair,
December 31, 1951.

1. Krishnamurty, V. G., *Curr. Sci.* (In press).

PREPARATION OF 1-AMINO-4-HYDROXYANTHRAQUINONE

THE analytical reagent, 1-Amino-4-hydroxyanthraquinone is not available commercially and methods for its synthesis are covered by patents. Beilstein[1] mentions 7 methods. A successful synthesis was achieved by the following method:

p-Amino-phenol hydrochloride (6 g.) was placed in a dry round-bottomed flask (250 c.c.) and treated with concentrated sulphuric acid (sp. gr. 1·840; 15 c.c.) in small quantities until effervescence due to evolution of hydrogen chloride gas slowed up. The flask was heated on a water-bath until all the hydrogen chloride was driven out. Finely powdered phthalic anhydride (12 g.) was now added to the flask and thoroughly mixed. Boric acid (12 g.) was finely powdered and introduced. More sulphuric acid (15 c.c.) was added to make the mass pasty. A reflux air condenser closed with calcium chloride tube was attached to the flask and the latter was heated in an oil-bath gradually to 120° C. This temperature was maintained for 10 hours with occasional shaking. The end of the reaction was indicated by the entire mass becoming red. After cooling, the contents were poured into water (300 c.c.). The solid mass was filtered and washed with small quantities of water. The residue on the filter was boiled with water and filtered hot. The process was repeated three or four times with the residue to remove phthalic and boric acids completely. This was found to be the most tedious aspect. The final product was obtained as purplish red crystalline powder, m.p. 206° (Beilstein 207-208° C.). Yield 7·2 g. (Theoretical yield 10 g.). It was soluble in alcohol and benzene with a fuchsine red colour. Alkalis and acid solutions of concentration greater than 0·5 N dissolved the compound. The colour in alcohol and acid was red and in alkali purple.

Waltair, N. APPALA RAJU.
December 11, 1951. M. KANTHARAJ ARS.
K. NEELAKANTAM.

1. Beilstein, *Handbuch der Organische Chemie*, 1933, **14**, 268.

OCCURRENCE OF DETRITAL KYANITE, ANDALUSITE AND GARNET IN THE GULCHERU AND PULIVENDLA QUARTZITES

THE Gulcheru and Pulivendla quartzites are the basal members of the Papaghni and Cheyair Series respectively of the (Pre-cambrian) lower Cuddapah formations. Their outcrops are well seen to the west of the village Royalcheruvu in the Ananthapur District (Madras) and form a low range of hills trending in a general North-South direction.

During the course of an investigation of the heavy mineral constituents of the samples of these rocks obtained from near Royalcheruvu, the invariable occurrence of kyanite, andalusite, and garnet was repeatedly noticed by the author.

(i) Kyanite occurs in colourless, small, straight, bent or twisted blades showing vertical cleavages traversed by horizontal partings. They are quite fresh and invariably show corroded borders. Some grains are cloudy due to alteration while a few have been completely reduced to micaceous aggregates. It forms about 1% of the total residue.

(ii) Andalusite is not more than one or two grains per slide and generally smaller in size than kyanite. It is colourless to pale blue, and feebly pleochroic from colourless or pale blue to pale pink. It also shows corroded borders.

(iii) Garnet is also not more than one or two grains per slide and is pale to deep pink in colour, quite fresh and shows corrosion structures like deep re-entrants and highly angular outline.

The other minerals present in the residue apart from these are iron ores, zircon, rutile, tourmaline and apatite.

The stability relations of kyanite, andalusite and garnet have been widely discussed by several writers like Smithson, Pettijohn, Bramlette, Dryden and Dryden, Hutton and others. Though these minerals may be able to withstand a certain degree of transportation over long dis-

tances and abrasion, they are considered to be highly vulnerable to post-depositional processes like the solvent action of interstratal solutions. The present trend of opinion is in favour of interstratal leaching as a more potent factor in controlling the nature and character of heavy mineral assemblages of sedimentary rocks than either the distance of transport or the resistance of minerals to abrasion during transport. Smithson[1] has observed corroded grains of garnet and kyanite in the Mesozoic rocks of Yorkshire and has considered their corrosion as due to the solvent action of interstratal solutions. Further, he has listed them as 'unstable' in the stability series established by him for the heavy minerals of the Mesozoic rocks of this area. Pettijohn[2] in his 'order of persistence' for 22 commonly occurring heavy minerals throughout the geological column arranged in the decreasing order of their persistence has placed garnet as No. 4, kyanite as No. 10 and andalusite as No. 13. He has also concluded that the simplified assemblages of most of the ancient sediments are mainly due to the removal of most of the vulnerable minerals originally present in them by interstratal leaching. Bramlette[3] has also offered a similar explanation for the total disappearance of garnets from ancient sediments. Dryden and Dryden[4] have shown garnet to be even less resistant to weathering than hornblende. Very recently Hutton[5] has expressed the opinion that garnet may be completely dissolved from water-lodged gravelly sediments mainly as a result of the action of interstratal solutions.

According to Pettijohn[6] kyanite is not known to occur in sediments older than lower palæozoic and andalusite from rocks older than upper palæozoic. Garnet, though found in rocks of all ages, appears to become poorer and poorer as the geological antiquity of the rocks increases. Hence the occurrence of these minerals now noted in the rocks of lower Cuddapah formations of older Pre-Cambrian age is specially interesting and may be of correlative value.

The presence of these minerals in the Gulcheru and Pulivendla quartzites of the lower Cuddapah formations in this part of the Cuddapah basin may also be due to certain special environmental conditions. Mackie[7] has shown calcium carbonate in a solid state as capable of preventing mineral grains from corrosion by interstratal solutions. Boswell[8] has argued that rocks of low porosity together with a superficial cover of clayey beds are protected to a greater extent from the drastic action of interstratal solutions than the loose-textured and unprotected sediments. In the present case it is known that the Gulcheru quartzites are succeeded in the stratigraphical sequence by a fairly large thickness of Vaimpelle limestones, and the Pulivendla quartzites by the equally thick Tadpatri shales. Hence the persistence of detrital kyanite, andalusite and garnet in these quartzites may be due to the protective cover offered by Vaimpelle limestones and Tadpatri shales.

Further work on these rocks is under progress and the results will be published elsewhere.

The author is highly thankful to Prof. L. Rama Rao and Dr. P. R. J. Naidu for their valuable guidance.

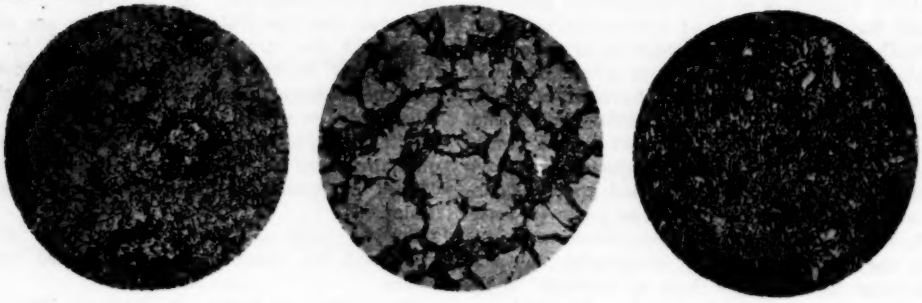
Department of Geology, C. GUNDU RAO.
Central College,
Bangalore,
January 22, 1952.

1. *Geol. Mag.*, 1941, **78**, 100,104 and 108-09. 2. *Jour. of Geol.*, 1941, **49**, 618-25. 3. *Jour. Sedim. Petrol.*, 1941, **11**, 35. 4. *Ibid.*, 1946, **16**, 94. 5. *Bull. Geol. Soc. Ame.*, 1950, **61**, 663. 6. *Jour. of Geol.*, 1941, **49**, 612. 7. *Trans. Edin. Geol. Soc.*, 1923, **11**, 149. 8. *Q.J.G.S.*, 1941, **97**, 65.

FABRICATION OF ALUMINIUM BRONZE BY POWDER METALLURGY METHOD

WHILE studying the problem of fabricating alloys by powder metallurgy method, it was found that rapid homogeneity could be brought about if the rate of diffusion between partially soluble metals was accelerated by heating one of the metallic constituents above its melting point. This phenomenon has been adopted for fabricating alloys like tungsten carbide, etc., when cobalt is introduced as the binding material. A modified form of the same principle may be adopted in fabricating binary alloys, where the difference between the atomic radii of the constituents is not very large.

Alloys have been prepared by the above method with success. Below is described a method of fabricating aluminium bronze, i.e., alloys of copper and aluminium. Electrolytic copper powder freshly reduced in hydrogen at 300° C. was ball-milled with different proportions of chemically pure aluminium powder; the particle sizes being respectively $-200, +300$ and $-100, +200$ mesh. Mixtures were pressed in a nickel-chrome-molybdenum steel die



Photomicrographs of Aluminium alloys. Sintering temperature: 900°C. Sintering time; 32 hours.
1·0% Aluminium × 170. 10·0% Aluminium × 170. 12·0% Aluminium × 170.

(length 3·0" width 0·33" and depth 1·5"), which was housed in a cast iron bolster, at a pressure of 25 tons per square inch. Sintering temperatures were selected from the thermal and dilatometric curves. It was found that sintering in pure hydrogen at 900° C. for 32 hours, a perfectly pure homogeneous alloy was obtained. The microstructure of the alloys thus obtained containing 1, 10 and 12% aluminium are illustrated here. The figures clearly show formation of a solid solution of aluminium in copper and the $\alpha + \delta$ structures as expected from the equilibrium diagram. The very dark areas in the photomicrographs are voids which are invariably formed at such low compacting pressures. The mechanical properties of the alloys were determined using a Hounsfield Tensometer. Test pieces were made to size No. 13 having a cross-sectional area of ·025 sq. in. and gauge length 0·632". The results obtained are as follows:

Aluminium %	Maximum stress (ton/sq.in.)	Breaking stress (ton/sq.in.)	Elongation %	R.A. %
1	7·8	5·5	15	9
4	8·7	7·0	8	4
8	11·2	8·0	8	4
10	11·1	10·9	4	0
12	17·4	17·4	4	0

The above work was carried out at the Hadfield Research Laboratory, The University, Sheffield. Fuller details of the production of aluminium bronze by this method will be published elsewhere.

Development Research Lab., A. GUPTA.
The Assam Oil Company Ltd.,
Digboi, Assam.
October 13, 1951.

THE SEEDS OF *WALKOMIELLA INDICA*—A CONIFER FROM THE LOWER GONDWANAS OF INDIA

WHEN we were studying coal from the Barakar stage by bulk maceration with concentrated nitric acid we obtained, besides microspores, a surprisingly large number of megaspores, small pieces of leaves and shoots, etc. From leaves

we were able to identify a new species of conifer, *Walkomiella indica*, a detailed description of which is in the press. From the same coal

we have obtained isolated seeds and some seeds attached terminally on short shoots. A close examination of the epidermal characters of the scale leaves of the seed-bearing short shoots showed that these seeds belong to the conifer, *Walkomiella indica*. The ovule or seed is bilaterally symmetrical, atropous and oval. It measures 2-2·5 mm. × 1-1·5 mm. Three layers, consisting of an integument, nucellus and a megaspore can be distinctly made out as shown here in the figure. The preservation is excellent and a detailed description will be published elsewhere.

Glossopteris flora is supposed to be relatively poor in species. Moreover, our knowledge of these plants is incomplete, which is partly due to the lack of suitable material. From our experience we find that the wealth and varieties of fossils which we can obtain from the maceration of large pieces of coal in bulk is, to say the least, surprising. Herein lies a new approach to the problem which will bring to light new facts about *Glossopteris* flora.

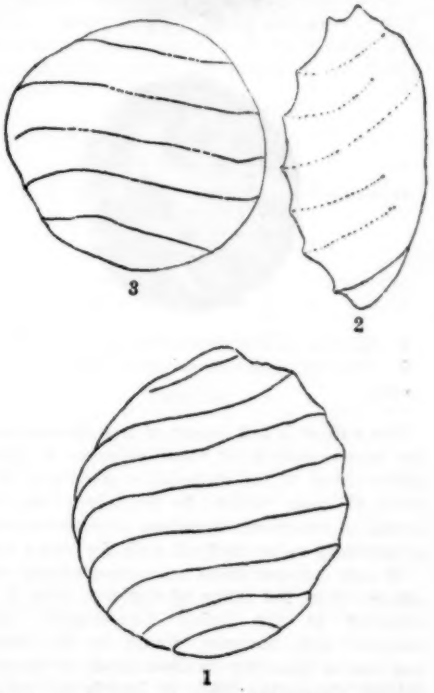
Birbal Sahni Inst. of Palæobotany,
53, University Road,
Lucknow,
September 27, 1951.

K. R. Surange.
Prem Singh.

CHAROPHYTE REMAINS FROM THE JURASSIC OF RAJMAHAL HILLS, BEHAR

This note describes what is believed by the author to be the first record of Charophyta in the Gondwana rocks. Prof. S. R. Narayan Rao of the Lucknow University, who has been kind enough to examine the slides, has supported this observation and is of the opinion that the specimens belong indubitably to the Charophyta. Charophyte remains from different geological horizons in the northern hemisphere have so far been found mostly in the form of casts or silicified material of Gyrogonites and vegetative shoots. In India they are so far known only from the Deccan Intertrappean beds and consist chiefly of fruits (oogonia), in one case with the stem attached.[4,5,6,7] The specimens described here are oospores referable to Nitellæ. About a dozen specimens* have so far been discovered in thin sections of chert collected by the late Prof. B. Sahni and party in 1948 from Nipania near Amrapara in the Rajmahal Hills.

Description.—No vegetative organs have yet been observed. The oospores are small in size, ranging from about 130 μ to 150 μ long and about 80 μ to 145 μ broad. Most of them appear laterally compressed in the sections (Figs. 1-2), but others are spherical (Fig. 3). The oogonium is not preserved. This may be due to its walls not being calcified as is the case in modern Nitella.[1,3] All the specimens show distinct ridges which vary from 5-9 in number and ascend from right to left. The ridges show that the angle of convolutions is very low. The spirals are concave in some oospores (Fig. 2), and convex in others (Fig. 1), indicating respectively the



1. Oospore laterally compressed showing convex ridges (×200).
2. Oospore obliquely placed showing concave ridges (×200).
3. Oospore spherical in shape (×200).

convexity or the concavity of the spiral cells in the oogonium.

The oospore wall in all the specimens possesses an ornamentation formed of polygonal meshes. The meshes are more or less of uniform size and tend to be arranged at places in tiers at right angle to the ridges. The number of meshes counted in vertical row from ridge to ridge varies from 5-9.

* The material was kindly given to me for investigation by Dr. R. V. Sitholey.

Affinities.—The distinctive characters of the present fossil oospores are the reticulate ornamentation of the wall, their small size, and laterally compressed form.

4

5

4. Spherical oospore showing reticulation (×200).

5. Laterally compressed oospore showing reticulation (×215).

The author is not aware of any description of the ornamentation of fossil oospores of Charophyta. Most of the material is preserved in the form of casts which do not show the finer details of structure; therefore, comparisons have of necessity to be confined with the living types.

In size, our specimens are comparatively much smaller than the range of size met with in the oospores of the living Charophyta. Small oospores are, however, found in the Nitellæ and among these the smallest occur in the genus Nitella, measuring 160 μ in length by 175 μ in breadth.[2] The Rajmahal specimens approximate most closely to this size.

The form of the oospore has been looked upon as a character of no less importance in distinguishing Nitellæ from Charæ. The laterally compressed form is known to occur only in the Nitellæ, though terete oospores are also found in this group. In the Charæ only the terete form occurs. The fossil oospores thus compare with those of the Nitellæ.

The sum total of the characters, i.e., (1) their small size, (2) the laterally compressed form, and (3) the reticulate ornamentation of the oospore wall indicates for the Rajmahal fossils a greater affinity with the Nitellæ than with the Charæ.

Birbal Sahni Inst. of Palæobotany, Lucknow, *October* 15, 1951. VISHNU MITTRE.

1. Fritch, F. E., *Camb. Univ. Press.*, 1948, **1**. 2. Groves, J., *Jour. Linn. Soc.*, 1924, **46**. 3. —, and Bullock, Webster, G. R., *Roy. Soc. Lond.*, 1924, **2**. 4. Rao, L. R., *Curr. Sci.*, 1938, **7**, 5. 5. Rao, K. S. and Rao, S. R. N., *Mem. Geol. Surv. Ind. Pal. Ind. N. S.*, 1939, **29**, 2. 6. Sahni, B. and Rao, S. R. N., *Proc. Nat. Acad. Sci. Ind.*, 1943, **13**, Pt. 3. 7. Sahni, B., Rao, H. S., *Ibid.*, 1943, **13**, Pt. 1.

MANGANESE MICAS FROM A PEGMATITE IN INDIA

THE schists and the pegmatite of the Sitasaongi manganese mining area* are very rich in mica. The schists contain muscovite and biotite, while the micas found in the pegmatite show some unusual characteristics. Two varieties have been distinguished in the micas from the pegmatite, based on the differences in the megascopic and microscopic character, *viz.*, (1) alurgite, (2) manganophyllite.

(1) *Alurgite.*—Two specimens (V/291 and V/288), collected from the pegmatite at 140′ and 60′ levels of the Sitasaongi Mine very closely conform to the description given by Dana (1892, p. 635). The mineral is dark-red in colour and the fine splittings when held before light look deep brownish red in colour. Hexagonal plates of the mineral are also met with. The mineral when heated to a high temperature turns white but regains its colour on being moistened.

In thin sections, the mineral is brown or reddish-brown in colour and shows a marked pleochroism. The pleochroic scheme is:

X = pale brownish yellow,

Y = reddish brown and brownish yellow.

The mineral is uniaxial to biaxial negative. When biaxial, 2 E does not exceed 4°. Fermor (1909, p. 198), has included all pink micas under the name alurgite even though their optic axial angles reach as high a value as 59°-65°.

The mineral when mixed with the usual fluxes gives a definite test for manganese.

(2) *Manganophyllite.*—In the pegmatite at 140′ and 60′ levels of the Sitasaongi Mine, some deep brownish-red mica plates and lumps were collected. In hand specimens, this mica has a

* Chikla area under study—Bhandara District. Lat. 21°31′ and 21°35′ N. and Long. 79°41″ and 78°49″ 30′ E.

different look from the mica described above. In thin section, the mineral is reddish-brown in colour and shows a marked pleochroism, the pleochroic scheme is:

X = straw yellow,

Y = deep orange brown.

The mineral is biaxial negative with 2E varying between 30°-35°.

Manganophyllite differs from alurgite in its physical as well as optical properties. The optic axial angle is 0°-4° for alurgite and 30°-35° for manganophyllite.

The mineral, like alurgite gives definite tests for manganese. The identifications are provisional because chemical analysis and detailed optical work could not be undertaken.

It is suggested that these micas are the original constituents of the pegmatite. It may be assumed that a part of iron and alumina has been replaced by manganese, and that this small amount of manganese is responsible for the properties like pleochroism, etc., exhibited by them.

Grateful thanks are due to the C.P. Manganese Ore Co. Ltd. (Nagpur), for providing facilities for this work and to Prof. N. L. Sharma and Dr. M. S. Sadashivaiah for their helpful guidance.

A.I.S.M., S. A. BILGRAMI.
Hindubagh (Pakistan),
October 20, 1951.

1. Dana, E. S., *System of Mineralogy*, 6th Edition, 1892, 635. 2. Fermor, L. L., *Mem. Geol. Surv. India*, 1909, **37**, 198.

PHAGOCYTIC COEFFICIENTS OF CERTAIN INDIGENOUS MEDICINAL PLANT EXTRACTS

IT was noticed in a preliminary survey that some of the medicinal plants of reputed therapeutic action had little antibacterial effect on the test bacteria *Escherichia coli* and *Staphylococcus aureus* (unpublished work). Hence it was considered worthwhile to study the action, if any, these plants might have on the phagocytic function of human blood leucocytes *in vitro*. The results are presented in this paper.

Leaves of *Murraya kœnigii* Spreng. and nuts of *Areca catechew* Linn. were selected for a study in contrast since the former which are singled out for setting right "blood disorders"[1] presumably by aiding the phagocytic function and other disease-resisting factors in live tissues) could be examined with the latter, which is a popular chewing item, usually believed to be associated with a lowering of body-resistance and a consequential increase in susceptibility to diseases like tuberculosis known to be connected with a low phagocytic index. For experimental work the reaction mixture consisting of 0·1 ml each of normal saline, the extract or its dilution in saline, citrated human blood[2] (final citrate concentration in blood being 0·02 M) and a uniorm suspension of *Micrococcus citreus* (more amenable than other pathogenic Micrococci for reason of the absence of plasma coagulase) was incubated for 30 minutes in a 37° C. water-bath, whereafter the leucocytic 'cream' was separated from each mixture, spread, stained by Leishman's stain and a count of the engulfed bacteria made on 50 neutrophilic polymorphonuclear leucocytes. The phagocytic coefficient as defined by Davies[3] was calculated. The results are presented in Tables I and II.

TABLE I

Extract	Plant	Plant-part	Quantity in g	Solvent	ml solvent	How extracted
1	*M. kœnigii*	leaves	2	water	20	cold, overnight
2	,,	rachis	2	,,	20	,,
3	*A. catechew*	nut	10	,,	100	,,
4	,,	,,	10	saline	100	,,

TABLE II

Extract	Phagocytic coefficient at dilution						
	1 : 0	1 : 2	1 : 5	1 : 10	1 : 15	1 : 20	0 : 1
1	—[a]	—[b]	1·71	2·21	2·07	2·07	1·00
2	1·50[c]	1·07	1·28	1·28	1·35	1·21	1·00
3	0·40[d]	0·80[d]	1·20	1·00	0·95	1·10	1·00
4	0·30[d]	0·85[d]	0·95	1·15	0·95	0·90	1·00

a, Clot after incubation; *b*, Clot after centrifugation; *c*, Red blood corpuscles were lysed; leucocytes had ill-defined cell walls; *d*, The supernatant in these tubes was fairly turbid, the turbidity decreasing with increasing dilution; most leucocytes were completely distorted, the protoplasm of the neutrophilic leucocytes having acquired the basophilic stain.

The values for the phagocytic coefficients of the leaf extract of *M. kœnigii* indicate its favourable influence on the normal phagocytic function and amply justifies its use *in vivo* for blood disorders; the extract of its rachis has a lesser activity.

The findings for *A. catechew* substantiate the belief regarding the *in vivo* effect of the nut, as it has a depressing effect on the normal phagocytic function. In another series of experiments, details of which will be published else-

where, the phagocytic coefficients of both extracts were determined using blood from another individual with a view to check the values presented above, for these are known to vary with every individual. It was again noticed that the phagocytic coefficients were considerably low in the presence of undiluted extracts and when diluted out 1 : 2, and at greater dilutions, the values tended to reach the normal figures. Trauma to leucocytes due to the presence of the extracts was evidenced in all tubes, the neutrophilic cytoplasm of the leucocytes acquiring basophillic characteristics. The change in the morphology and staining reaction of the leucocytes in the presence of these extracts indicates the nature of the damage they are believed and are likely to bring about *in vivo*. Furthermore, a count made on the number of reacted leucocytes indicated that approximately 68, 86 and 98 per cent. had functioned in the phagocytic process at dilutions 1 : 0, 1 : 2 and 1 : 5 respectively. At higher dilutions, the percentage of reacting leucocytes approached normalcy, *i.e.*, 100 per cent.

St. Xavier's College, Microbiology Department, Bombay,
RAJUL BROKER.
J. V. BHAT.

November 21, 1951.

1. Kirtikar, K. R., and Basu, B. D. *Indian Medicinal Plants*, 2nd Ed., 1933, **1**, 472. 2. Gradwohl, R. B. H., *Clinical Laboratory Methods and Diagnosis*, 4th Ed., 1948 **2**, 1501. 3. Davies, G. F., *J. Path. and Bact.*, 1951, **63**, 149.

QUANTITATIVE DETERMINATION OF AMINO ACIDS SEPARATED BY CIRCULAR PAPER CHROMATOGRAPHY

VARIOUS procedures have been suggested for the quantitative determination of amino acids on filter-paper chromatograms. These may be classified into the following groups:

(1) Comparison of the colour intensity of standard and test sample chromatograms following treatment with ninhydrin, visually[1,2] or by photometry;[3-6] (2) Direct comparison of the size of ninhydrin stained spots of standard and test samples[3,7] or by making photostat prints from the negative of the chromatogram and measuring the spot areas with a planimeter;[8] (3) Elution of the spots before or after staining with the ninhydrin reagent and estimation of the amino acids in the eluates;[2,9-14,16] (4) Estimation of amino acids without elution[13,15] the reagent being added directly to pieces of paper containing the amino acid cut from the chromatogram.

Most of the methods require considerable manipulative skill and are also rather tedious to carry out.

We have attempted to develop a simple quantitative method based on the extraction of the colour of the ninhydrin stained zones with 75% alcohol[16] and comparison of the colour intensity with a known sample of amino acid similarly treated or estimation from a calibration curve drawn for each of the amino acids. By this method 3-5 μg quantities of amino acids separated on the chromatogram can be accurately determined.

The method briefly consists of the following steps: (1) Staining the amino acid zones after running the chromatogram as described before[17] with 0·5% ninhydrin reagent in acetone and drying it at 65° for about 15 minutes. (2) Cutting the zones stained with ninhydrin and introducing the papers roiled, into a test tube containing 4 c.c. of 75% alcohol and shaking for about 5 minutes until the colour is completely extracted. It was found that although acetone extracted the colour completely, the intensity of the colour obtained by extraction with 75% alcohol was nearly twice that obtained by acetone extraction. The colour was found to be stable for nearly 2-3 hours at room temperature. The ninhydrin colour of the alcoholic solution can be extracted by isoamyl alcohol and *n*-butanol. But the colour was not stable in these solvents. (3) Measuring the intensity of colour of the alcoholic extract using Klett-Summerson photoelectric colorimeter using 540 *mu* filter and a test tube 1 cm. in diameter. (4) The quantity of the amino acid can then be estimated from the calibration curve drawn for each of the amino acids. It is, however, desirable to verify the value obtained by calculation from the calibration curve by running the mixture of known amino acids of known concentration on the same paper and comparing the colour intensities of the solutions with those obtained by running the mixture of unknown amino acids.

Using this method, circular paper chromatogram of threonine and isoleucine mixture run with *n*-butanol-acetic acid-water as the solvent gave recoveries of 98-100% for threonine and isoleucine.

Typical calibration curves obtained with cystine, tyrosine, iso-leucine, valine and glycine in the range of 3·2-12·8 μg showed direct proportionality between optical density and con-

centration. This method when applied to the estimation of phenylalanine and tyrosine in casein hydrolysate after separation of the amino acids by circular paper chromatography[17] gave values of 5·05 and 6·3 respectively. The values were calculated on the basis of 16 g. of nitrogen per 100 g. of casein.

The simplicity of the technique combined with its sensitivity and accuracy makes it an excellent method for the amino acid analysis of proteins in plants and animal tissues, blood and urine.

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A DIRECT VOLUMETRIC PROCEDURE FOR ESTIMATION OF THORIUM*

VOLUMETRIC methods so far reported for the estimation of thorium[1–8] have been considered to be "either involved, highly indirect, or inaccurate".[9] A simple, direct and accurate titrimetric procedure for estimation of thorium is presented in this note.

The method consists in titrating a known volume of standard oxalic acid solution against thorium nitrate, using alizarin S as internal indicator. Thorium oxalate is precipitated in the course of titration; the end point is indicated by a sharp change in colour from yellow to red owing to formation of red thorium-alizarin lake. This procedure has been successfully used with 0·1 N solutions. When 0·01 N solutions are employed, however, the end point is found to be sharp only when the titration is completed at about 90° C.

Close agreement has been observed between results obtained by the gravimetric procedure (in which thorium is precipitated as oxalate, ignited and weighed as oxide) and the volumetric procedure described herein.

In place of oxalic acid, oxalates can also be employed, provided the requisite amount of acid is also added. Other dibasic acids and organic acids so far proposed for gravimetric estimation of thorium have been tried in place of oxalic acid. Details will be published elsewhere.

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MUTUAL SUPPLEMENTATION IN VEGETABLE PROTEINS

PEANUT CAKE has received attention as a source of valuable protein supplement in human nutrition.[1] Cottonseed cake has also been suitably processed into a flour which could be used on a large scale in the biscuit industry.[2] Cocoanut cake and flour have been successfully used in combination with wheat flour for producing a fairly nutritive bread.[3]

Although oilcakes are valuable sources of proteins and are abundantly available, they require systematic processing so as to eliminate the toxic principles[4] and proteolytic inhibitors[5] present in some of them. The more common drawbacks that are mainly responsible in preventing oilcakes from being incorporated in food preparations are, (*a*) the unhygienic conditions under which these cakes are obtained, (*b*) the presence of stone and gritty matter,

* These studies were supported by a grant from the Indian Council of Medical Research.

(*c*) the bad flavour owing to unhealthy seeds being used during crushing, and (*d*) the development of rancidity as a result of the residual oil in the cake. If these defects could be eliminated, the product would find ready application as a source of supplementary food. Even so, oilcakes are low in biological value (varying between 50 and 60) due chiefly to deficiencies in essential amino acids, particularly lysine and methionine. It would seem, however, that when presented in suitable mixtures, they have fairly high biological value and our results on this problem are briefly discussed in this communication.

The biological value determinations were carried out by the nitrogen balance method of Chick, *et al.*[6] Peanut, cottonseed, sesame, soya, copra, wheat and yeast were used as protein sources. These were mixed in certain suitable combinations and in proportions as indicated in the Table. The protein level was 10% in all cases.

TABLE

Protein Value of Mixtures of Oilcake Proteins

No.	Mixture	Composition	Protein content	Biological value	Digestibility coefficient	Net protein value
1	Peanut	55				
	Wheat	25	47·15	70	91·3	30·13
	Cottonseed	20				
2	Peanut	60				
	Sesame	20	53·4	56	93·0	27·81
	Cottonseed	20				
3	Peanut	60				
	Yeast	10	57·41	60	86·9	29·92
	Cottonseed	30				
4	Peanut	65				
	Wheat	25	47·55	51	84·3	20·45
	Yeast	10				
5	Peanut	60				
	Soya	20	52·8	72·5	87·2	33·38
	Sesame	20				
6	Peanut	60				
	Cottonseed	20	52·4	60·8	87·3	27·81
	Copra	20				
7	Peanut	65				
	Yeast	10	50	55·5	88·9	24·6
	Copra	25				

The results show that while some mixtures of cake proteins like (*a*) peanut, wheat and cotton seed, and (*b*) peanut, soya and sesame, have given significant increases in biological value, others have shown little or practically no increase. A study of the data of the essential amino acid make up of these mixtures as reported in literature, did not help to explain satisfactorily the low biological value obtained in these cases. For a proper interpretation of these results, it is necessary to take into account the rate and timely release of the amino acids which are important factors for effective supplementation.[7] This is now being studied.

It would also appear from the results that oilseed (peanut) globulins are supplemented adequately either by cereal proteins like those of wheat or by the proteins from a legume like soya. A mixture consisting of only oilseed proteins, does not supplement peanut proteins.

It is also observed that wherever yeast formed one of the constituents of the mixture, the biological value is invariably lowered. This is perhaps, due to toxic factors, like amino pyridine, known to be associated with yeast.

Our thanks are due to Dr. S. S. De for his keen interest in the progress of this work.

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ALKALOIDAL CONSTITUENTS OF *WITHANIA SOMNIFERA*

IN continuation of the earlier work by Majumdar and Guha,[1] it has now been possible to isolate six alkaloids from the acetone soluble part of the total alkaloidal precipitate with Dragendorff's reagent. It has been further confirmed that one of these alkaloids is definitely nicotine. The remaining five alkaloids have been named as *somniferine*, m.p. 185-87°; *somniferinine*, m.p. 120° after primary decomposition between 95-100°; both are alcohol soluble but chloroform insoluble; *withanine*; m.p. 87-88°, chloroform soluble but ether and benzene insoluble; *withananine*, m.p. 35-40° ether and benzene soluble; *withananinine*, m.p. 90-95°, benzene soluble but ether insoluble. They are all coloured brown. Further work is in progress.

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BIOLOGICAL STANDARDISATION OF DIGITALIS USING DOGS

RICHARD[1] in a general survey of assay methods for the cardiotonic group of drugs found that the dog generally reacted to intravenous administration, but the response could in no way be correlated either with the weight of the animal or to the dosage of the drug given. He therefore opined that dogs were unsuitable for the assay of this group of drugs, Haskell, *et al.*[2] and Tiffeneau, Levy and Pichot[3] using dogs for the bioassay of digitalis came to the conclusion that a fairly satisfactory assay may be carried by using from 6 to 10 dogs for each test, the average value for the dog being 1·75 times the M.L.D. for cats. McGuigan and McGuigan[4] used dogs anæsthetised with phenobarbitol (35 mg per kilo body weight in 5% alc. solution given intraperitonially) and tincture digitalis was injected to femoral vein in a dose of 0·1 c.c. per kilo of body weight every 5 minutes and continued for 1 hour. Artificial respiration was not given in every case. They concluded that in the case of the dog, the results were within 20% of the actual strength of the drug.

In our work we used dogs weighing from 1·9 to 5 kg. of body weight. They were anæsthetised by seconal sodium (30 mg. per kg. of body weight given i.p.). Blood pressure and respiration were recorded in some cases. Artificial respiration was not resorted to. Tincture digitalis was perfused through the femoral vein at the rate of 2-3 c.c. of diluted tincture (1 : 20) so that the rapid fall of blood pressure occurred after 30 minutes and not later than 1 hour in each case. The data obtained for the standard,* and samples of tincture sent for analysis to our laboratory are given below:

TABLE I

Bioassay of Tincture Digitalis (Dilution 1 : 20)

Expt. No.	Standard		Sample	
	Wt. of dog in kg	Dose given per kg in c.c.	Wt. of dog in kg	Dose given per kg in c.c.
1	5·4	30	4·5	29·2
2	4·5	42·3	4·05	29·0
3	4·4	26·7	3·71	45·4
4	4·1	23·5	3·26	29·04
5	3·6	22·8	2·5	34·0
6	2·1	22·8	1·9	27
Average per kg body weight of dog		28·01		32·2

It is evident that the error is within 10% of the value, 29·75 c.c. obtained by McGuigan, *et al.*,[4] for the international standard. The individual variation when many dogs are used is not more than with cats. David, *et al.*,[6] also got the same result using the 1926 international standard.[5] Therefore, it may be safely concluded that the dog can replace the cat without any sacrifice of accuracy of results. Also dogs are more easily available in our country than cats and more convenient to handle too. Hence, for the bioassay of tincture digitalis by the dog method 28·0 c.c. per kg of body weight can be taken as the standard dose.

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* The standard digitalis leaf powder (1936 standard) was supplied by the kind courtesy of the Director, Biochemical Standardisation Laboratory, Calcutta.

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RING DISEASE OF POTATO IN INDIA

Phytobacterium solanacearum (Sm.), Patel and Kulkarni, the causal agent of the ring disease of potato was first recorded in India in 1892. Considerable work has been done on it in Mysore and Bombay by Coleman[2] and Mann and Nagpurkar.[3] The disease is now found in almost all the potato-growing areas of the world. In Bombay State, it used to be a limiting factor in the cultivation of potato as the cultivators used the same stock for 6-10 seasons (3-5 years). It has, however, now ceased to be of importance since seed potatoes are imported annually from the snow-fed, disease-free hills of Simla (altitude, 7,000 ft.).

A similar disease, producing identical symptoms caused by *Aplanobacter sepedonicum* (Spiek. and Kott.) Sm., was reported from Germany in 1913 from where it has made its way to Canada and U.S.A. Many Indian investigators feel doubtful about the identity of the

Characters	Indian potato ring pathogen	*Phytobacterium solanacearum*	*Aplanobacter sepedonicum*
Motility	Motile	Motile	Non-motile
Gram's stain ..	Negative	Negative	Positive
Nutrient broth ..	Poor growth, cloudy colour turning brownish, no pellicle	Appreciable turbidity and distinct pellicle.	Poor growth. Shade of yellow colour, no pellicle.
Nutrient agar slants ..	Growth poor to fair, flat, dull, whitish, putrefactive smell.	Growth poor, dirty white to brown.	Growth poor, shade of yellow colour.
Nutrient dextrose agar slants ..	Abundant growth, medium turning acidic.	Dirty white, turning brown.	White and good growth.
Potato dextrose agar slants ..	Good growth, dirty white, smooth, glistening, flowing	Abundant growth and intense production of pigments.	Abundant growth and intense production of pigments.
Potato cylinders ..	Good, slimy, flowing, dull, smooth growth, turning dirty white to brown.	Colour changed to brown.	..
Temperature relations—			
Minimum ..	10° C.	10° C.	4° C.
Optimum ..	25° C.	35–37° C.	20–30° C.
Maximum ..	35° C.	41° C.	31° C.
Liquefaction of gelatin ..	Nil	Slight	Slight
Hydrolysis of starch ..	Nil	Nil	do
Production of H_2S ..	Nil	Nil	do
Indole production ..	Nil	Nil	Nil
Citmus milk ..	Alkaline	Alkaline	Slight reduction
Litrates ..	Reduced	Reduced	Not reduced
Carbon utilisation—			
Lactose ..	Alkaline	Alkaline	Acid
Maltose ..	do	do	No change
Inulin ..	do	do	Neutral
Xylose ..	Neutral	do	Acid
Dulcitol ..	do	do	Alkaline

ring disease organism in India and as some have even stated it to be due to *A. sepedonicum*, the writers collected diseased potato tubers of the variety Great Scott from the Nilgiris, Numbri (up-to-date) grown locally, Darjeeling red from Darjeeling, Phulwa from Patna (Bihar), Italian White grown locally and at Farukabad (U.P.), from which the pathogen was isolated and studied in detail. The results of our investigation of ring and brown rot disease are given above.

Chilli and tobacco are not affected. The organism causes a wilt in tomato, potato and egg plants. Typical symptoms manifest after 3-5 days, but actual wilting is seen after 7 days Virulence is lost in culture within 3 months; however, the organism can be best maintained in milk. Periodical plantings indicate that it remains viable for about 8 months in sterilised soil.

The symptoms of the disease and the morphological, cultural and biochemical characters of the ring pathogen isolated from potato tubers grown at several places show conclusively that the organism is identical with *Phytobacterium solanacearum* (Sm.) Patel and Kulkarni.

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VERNALIZATION OF PEAS

A NUMBER of leguminous crops have been vernalised during the last decade.[1,2,3,4] However, no work appears to have been reported on the effect of vernalisation on formation of root nodules and their nitrogen fixing capacity in leguminous crops. The present study was therefore taken up, to record response of pea variety N.P. 29, to vernalization.

The seeds were vernalized at 45° F. for four weeks (A), Six weeks (B), Eight weeks (C) and no vernalization (D). After treatment, they were sown in microplots in the field. They were given normal interculture and irrigations. No manures were added. Flowering, root nodule formation and grain yield were recorded, which are given in the Table I.

TABLE I

Showing Flowering, Number of Root Nodules and Grain Yield of Vernalized Pea Seeds

Treatments	Flowering in days	Number of root nodules per plant	Grain yield in g.
A	67	35·5	998·8
B	72	22·0	1013·2
C	69	20·2	965·6
D	69	8·5	598·4

Peculiarly enough, no marked earliness was observed in the treated plants. Maximum earliness of 2 days and lateness of 3 days were obtained as given in Table I. The treated plants tended to remain green, for a longer time, in field. The results are in conformity with Tulaikova's[5] findings who reported an earliness of 6-9 days in peas due to vernalization.

The number of root nodules formed, after 78 days was counted, and the results (average of 4 plants) are given in Table I. A marked increase in the number of root nodules per plant was observed due to vernalization. It was highest in the seeds which were treated for 4 weeks.

The grain yield of 68 plants was recorded separately for each treatment by weighing the grain and the results are shown in Table I. The increase in yield may be attributed to vernalization which accelerates the physiological processes as suggested by Maximov.[6] Further studies are in progress.

The author wishes to express his thanks to Dr. L. B. Singh, for his valuable comments and guidance.

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OCCURRENCE OF PERSISTENT POLLEN TUBES IN MALVACEAE

IN the majority of Angiosperms, the pollen tubes after reaching the embryo-sac, discharge their contents, collapse and become unrecognisable a little later. But in some cases they are reported to persist till a late stage in the development of the embryo (see Maheswari, 1950, for literature; also Maheswari and Johri, 1950). In a few of these cases the pollen tubes remain intact and serve a haustorial function as those of Malvaceæ described below.

In other families of Malvales, namely, Sterculiaceæ, Tiliaceæ and Elæocarpaceæ studied by the writer, the pollen tubes were ephemeral as in the majority of Angiosperms. But in *Pavonia zeylanica* L., *Sida veronicæfolia* L. (= *S. humilis* Willd.), *Malachra capitata* L., *Hibiscus micranthus* L., *H. hirtus* L., and *H. solandra* L. Herit. belonging to Malvaceæ, whose embryology was studied by the writer, the pollen tubes were found to persist in tact till a late stage in the development of the embryo (Fig. 1).

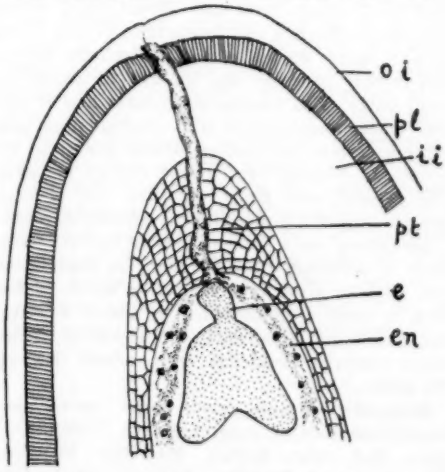

FIG. 1. L. S. seed of *Hibiscus solandra* showing persistent pollen tube. ×80.

The pollen tubes measure 15-20 μ in diameter. After reaching the tip of the nucellus, they give off a few branches one of which may reach the inner integument, while the main tube progresses towards the egg. Even after discharge of the gametic nuclei, the tube does not collapse or show signs of degeneration. It is provided

with a tough membrane which is lined on the inside by a thin layer of cytoplasm. Its open end stands very near to the base of the developing embryo. In all the species investigated, the embryo develops rapidly reaching maturity in 5-6 days. So it is probable that the pollen tube functions in the rapid transport of food materials from the parenchymatous cells of the inner integument several layers of which get crushed during the development of the seed.

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RAW-RICE WASHINGS—A SOURCE FOR CANE GROWTH FACTORS

BONNER, HAAGEN-SMIT AND WENT[1] have shown that seed diffusates and extracts of young leaves contain many of the important growth principles which promote the growth of plants or plant parts. Van Overbeek, Conklin and Blakeslee[2] have demonstrated that coconut milk provides accessory substances which stimulate the growth of isolated very young Datura embryos. The present note deals with the use of raw-rice wahings for promoting the growth of plants.

According to a recent report in the daily press, a Sorghum (Jowar) plant in East Godavari District grew to a height of about 16 feet with a stem circumference of about 4 inches and produced an earhead of about 15 inches when raw-rice washings were added daily to the plant.

Experiments were made with seven poor vigour varieties of sugarcane, *viz.*, *Vellai*, *Gillman*, *Red cane*, *Karun*, *Mauritius* 33, *Ashy Mauritius* and *Toungoo Yellow*, which have been grown for three months, from the time of germination, in sand cultures, with additions of (*i*) Buffered Knop's[3] solution containing all micronutrients once in a fortnight, and (*ii*) raw-rice washings, daily. Raw-rice washings have a definite growth-improving action on sugarcane and is characteristically seen in the main shoot heights of the plants given in Table I.

Height in inches of Main Shoots of Different Canes

(After 3 months' growth in sand cultures)

Treatment \ Variety	Vellai	Gillman	Mauritius 33	Red cane	Karun	Ashy Mauritius	Toungoo Yellow
(*i*) Buffered Knop's solution containing all micronutrients	37·6	29·3	12·9	37·0	15·8	11·6	10·7
(*ii*) Rice washings	51·0	45·7	50·3	36·9 (Borer)	40·8	42·3	51·7

The nature of the physiologically active substances present in rice washings which give them their stimulating property is under investigation, and the results will be published elsewhere.

Grateful thanks are due to Shri N. L. Dutt, Director, for his keen interest in the work and for many helpful suggestions.

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ARSENOPHOSPHOTUNGSTIC ACID—A MICROREAGENT FOR CERIUM

KOMAROVSKY AND KORENMANN[1] reported the use of phosphomolybdic acid for the detection of microquantities of cerium. The author tried phosphotungstic acid for the same purpose, but without success. The observations were next extended to arsenophosphotungstic acid—Benedict's reagent,[2] which produced a characteristic blue colour when a drop of it was treated with a drop of any cerous salt solution and of 30 to 40% sodium hydroxide successively on a spot test tile or paper. Under comparative conditions the intensity of the colour was found to be the same as that obtained with phosphomolybdic acid. The determination of the concentration and identification limits showed that cerous ions in as small a quantity as 0·5 γ in one macro drop can be detected easily with this test.

Co, Cu and V interfere with the test because of the production of blue colour when

their salt solutions are treated with alkali even without the addition of Benedict's reagent. With the exception of certain rare earths, *e.g.*, Gd, Ho, Tm, Dy, Eu, Yb and Lu whose interference has not been so far studied due to the unavailability of their pure compounds, the above test is specific for trivalent cerium. Its applicability to colorimetric and chromatographic determination of cerium is under investigation.

Grateful thanks are due to Professor S. S. Joshi for facilities and constant encouragement during the work and to the National Institute of Sciences of India for the award of a Research Fellowship.

Department of Chemistry, G. S. DESHMUKH.
Benares Hindu University,
November 18, 1951.

1. Komarovsky and Korenmann, *Mikrochem.*, 1932, **12**, 211–14. 2. Benedict and Franke, *J. Biol. Chem.*, 1922, **52**, 387.

REGIONAL WATER CONTENT OF THE INTESTINAL WALL OF EARTHWORMS AND ITS SIGNIFICANCE

WITH reference to the difference in the water content of different regions of the body-wall of the earthworm,[1,2,3] it was considered worthwhile to examine the hydration of the wall of the intestine to ascertain if its different regions also exhibit a gradient similar to that in the body-wall.

The intestine of three species of earthworms, *Pheretima posthuma*, *Eutophœus waltoni* and *E. nicholsoni*, from segment XIV or XV upto the anal segment, was taken out and thoroughly dried between filter-papers to get rid of the body-fluids adhering to it. Each piece was then divided into an anterior and an approximately equal posterior part: these two parts were weighed in tared micro-crystal-glasses and dried in a hot air oven at 100° C. for 2 hours, in which time the weight became constant and remained so for well over 15 hours. The water-content of 100 gm. of the tissue was calculated from these weighings, and the mean of twenty-five estimations for each worm is given in Table I, along with the percentage difference between the anterior and posterior halves of the intestinal wall.

From the figures in Table I it will be observed that the intestinal wall of the posterior half of all the three species of worms examined has a higher percentage of extractable water than its anterior half. The difference in the water-content of the two halves (regions) of the intestinal wall for *P. posthuma*, *E. waltoni* and *E. nicholsoni* is 11·09, 6·40 and 8·44 per cent. respectively: this difference as compared with the difference between the water-content of the middle and posterior regions of the body-wall (0·78 to 1·17%) is of a much larger magnitude. Since the intestine in these worms is confined to post-clitellar region only, the difference in the water-content of the anterior and posterior halves of the intestinal wall has been compared with the difference between the middle and posterior regions of the body-wall. In *P. posthuma* the difference between the two regions of the intestinal wall is 11·09%, while the corresponding difference between the two regions of the body-wall is only 1%.

In all the worms employed for analysis the anterior and posterior regions of the intestine were full of earth, and as the water-content of the intestinal wall of the posterior region was found to be greater than that of the anterior region, it showed that when both the regions are functioning the intestinal wall of the posterior region is richer, and that of the anterior region poorer in its water-content.

TABLE I

		Percentage of water in 100 g. of the intestinal wall				Percentage of water in 100 g. of the body-wall		
		Anterior half of the intestine	Posterior half of the intestine	Difference between the anterior and the posterior halves		Middle or post-clitellar region	Terminal or anal region	Difference between the middle and anal regions
1	*Pheritima posthuma*	52·86	63·95	11·09	Dried over H_2SO_4	73·93	74·95	1·02
					Dried at 100° C.	73·99	74·99	1·00
2	*Eutyphœus waltoni*	60·56	66·96	6·40		..	..	..
3	*Eutyphœus nicholsoni*	58·64	67·08	8·44		..	..	..

A likely explanation for such a marked difference is that the anterior half of the intestinal wall is losing water as it secretes digestive juices into the lumen of the gut, while its posterior half is gaining water by absorbing it from the gut contents.* This is in agreement with the established conceptions regarding digestion of food in the anterior region of the intestine and its absorption in the succeeding region in the higher invertebrates.

It may, therefore, be concluded that there is as much functional heterogeneity in different regions of the intestine of earthworms as there is in the other higher invertebrates, in that its anterior region is secretory and the posterior mainly absorptive.

A complete account of this investigation will be published elsewhere.

I am grateful to Dr. K. N. Bahl for his valuable suggestions and constant encouragement.

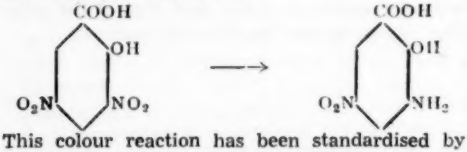
Department of Zoology, University of Lucknow, *November* 16, 1951. B. K. TANDAN.

* It may be noted that the earthy contents of the anterior region of the intestine are much more fluid and pultaceous as compared with those in the posterior half where they are more solid and compact and form rounded pellets or long winding strings[4].

1. Kopenhaver, Mary, E., *Physiol. Zool.*, 1937, **10**, 315. 2. Tandan, B. K., *Curr. Sci.*, 1951, **20**, 214. 3. Child, C. M., "Patterns and Problems of Development" 121. (University of Chicago Press, Illinois, 1941).

A COLOUR REACTION FOR CHLOROMYCETIN

SUMNER AND GRAHAM[1] first demonstrated the development of a brown colour on allowing sugars to act upon 2 : 4 dinitro salicyclic acid. The reaction involved is :



This colour reaction has been standardised by von Hœstler, *et al.*,[2] for the estimation of mono- and di-saccharides. Based on this reaction, Meyer, *et al.*,[3] have developed a rapid method for determining the diastatic activity of malts.

During a study of the action of antibiotics[4] on amylases, it was observed that chloromycetin and maltose behaved similarly in producing the characteristic reddish brown colour. Intrigued by this finding, various tests for sugars were carried out with chloromycetin. Fehling's, Benedict's, Phenylhydrazine, Molisch, Nylander, Barfœd, Selivanoff, Phloroglucinol and Benzidine tests were negative, whereas picric acid and dinitrosalicyclic acid tests were positive with chloromycetin. The colour tests with the last two reagents have been made quantitative for the estimation of chloromycetin. In Fig. 1

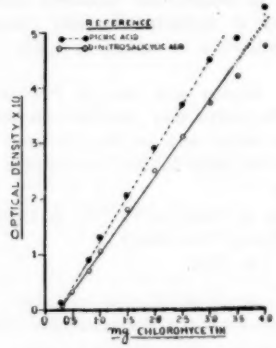


FIG. 1. Standard Curves for Chloromycetin with picric acid and dinitrosalycylic acid.

is reproduced the standard curves for chloromycetin with the two reagents. The tests were carried out as follows: to different concentrations of chloromycetin made up to 2 ml. were added 2 ml. of the colour reagent, the mixture heated in a boiling water-bath for 10 minutes, cooled to room temperature, diluted to 10 ml. and colours read in a Lumetron Photo-electric colorimeter using Green filter (530) against a reagent blank similarly treated.

For the preparation of the colour reagents 1 g of picric acid (Merck) or dinitrosalicyclic acid (prepared by direct nitration[5] of salicyclic acid) 30 g of Rochelle salt, and 20 ml. of 2 N NaOH were made up to 100 ml., heated in a water-bath cooled, filtered and used immediately.

The colour reaction was found to be sensitive over the range 0·5-3·0 mg of chloromycetin. The applicability of this method in the routine estimation of chloromycetin in biological materials as also the nature of the colour compound formed, are under investigation.

Central Drug Research Institute, Lucknow, *February* 7, 1952. K. L. ARORA. C. R. KRISHNA MURTI.

1. Sumner, J. B. and Graham, V. A., *J. Biol. Chem.*, 1921, **47**, 5. 2. Von F. Hœstler, Borel E. and Deuel, H., *Helv. chimica Acta.*, 1951, **34**, 2132. 3. Meyer, K. A., Bernfeld, P., Rathgeb, P., and Gurtler, P., *Ibid.*, 1948, **31**, 1536. 4. Arora, K. L. Krishna Murti, C. R. and Shrivastava, D. L., *Unpublished work.* 5. Beilstein, (*First Supplement*), **10**, 122.

REVIEWS

Essay in Physics. By the Rt. Hon'ble Viscount Samuel. (Blackwell, Oxford). Pp. 153. Price 7 *sh.* 6 *d.*

Recent advances in Physics show unmistakably that while philosophy is turning towards the causes of natural phenomena, physics tends to metaphysical speculation. The greatest triumphs in recent years have been won with the aid of mathematics. On the one hand, the effect has been a tendency to draw 'sweeping philosophical inferences', while on the other, speculations, which have no mathematical proofs and lie in the borderland between philosophy and physics, have been greatly discredited.

It is of interest to consider the distinction between fictional abstraction and physical fact. Unfortunately this distinction is becoming less clear cut in physics. For example, the space-time continuum may account for several observed physical phenomena but it has no objective existence. While undoubtedly inferences have to be drawn from the world of experiment and experience, such inferences must be considered with due regard to their limitations. They should also be elastic enough to suffer alteration in the light of new facts.

The physicist is thinking of measurements of events, but the philosopher is watchful of the events themselves and their ultimate causes. On this basis, the principle of indeterminacy cannot be accepted by the philosopher. The law of chance has no rational basis in an organized universe.

These are some of the ideas developed in this book. On these considerations, some outstanding problems are considered by the author. The nature of electromagnetic radiation and the medium for its propagation, the nature of gravitation, the nature of motion in general and of momentum in particular and finally, the nature of waves and particles are examined in detail in the light of current ideas.

According to the author, energy in the continuum exists in two states, quiescent and active, passing easily from one into the other. Quiescent energy is conceived as the continuum, the sole physical constituent of the universe. All material events are to be accounted for as cases of the activation of quiescent energy.

On these ideas, the foregoing outstanding problems of modern physics are considered and explanations are offered. The Planck constant h is suggested as the measure of the least impact that changes quiescent energy into active energy.

A letter from Professor Einstein is included in the book. He gives a clear analysis of the superiority of the field-theory as developed in the Special Theory of Relativity over the earlier contributions of Newton, Faraday and Maxwell.

Lord Samuel has shown a clear appreciation of the problems of present-day physics and the difficulties associated with them. While his solution may or may not find general acceptance with philosophers and physicists, there can possibly be no doubt that he has evinced (as Professor Einstein points out) an independence of mind, untrammelled by conventions or codes. The book is thought-provoking and goes to the root of our ideas relating to the structure of the universe. It is sure to be of interest to students of philosophy and physics.

S. R. R.

Statistics: An Intermediate Text-Book, Vol. II. By N. L. Johnson and H. Tetley. (Cambridge University Press), 1950. Pp. xi + 318. Price £ 1.

The present volume as well as the previous one published in 1949, have been written by actuaries and intended as an Intermediate Text-Book, but it is evident that their value will by no means be confined to actuaries, nor to those desiring to learn the elements of statistical theory. Examples are chosen which are relevant to the theory, and there is a great variety of them from actuarial as well as other fields. The outlook of the book is a thoroughly practical one.

The first volume dealt with descriptive statistics and large sample theory, and this volume includes the t test, the χ^2 test, the variance-ratio test, analysis of variance, correlation, etc. It can in the main be read by itself, although there are references back to the discussion of confidence intervals in the first volume.

The notation used is noteworthy. It is clear and carefully chosen, carrying out recognised principles. Some new symbols are defined on

p. 41, and a few elsewhere: one which will be very useful is a symbol for 'is distributed as'.

W. F. KIBBLE.

Sound Insulation and Room Acoustics. By P. V. Bruel; Translated from the Danish by J. N. Borup (Chapman and Hall), 1951, Pp. xi + 275. Price 35 *sh.*

Though Lord Rayleigh laid the basis for the science of Acoustics in his classic *Theory of Sound*, it was Wallace Clement Sabine at Harvard who applied the science to the practical problem of acoustical design of buildings, and since then, applied acoustics has been almost a monopoly of American scientists. The book under review, written by an eminent European authority on the subject is therefore doubly welcome as it embodies much of the valuable war-time research that went on in Western Europe and also because it brings a fresh approach to the problem.

The book is divided into six chapters, the first two of which deal with fundamental ideas, including the mechanism of hearing. In the third chapter are developed recent concepts of wave acoustics, particularly in relation to the behaviour of sound waves in a geometrical enclosure. A great deal of experimental data on absorbing materials is included in the next chapter and the sections on resonator absorbers are of special interest as it is sought to use similar devices in this country. The fifth chapter gives copious details on the design of structures for effective sound insulation. The last chapter outlines the main aspects for consideration in the design of acoustically good rooms with particular reference to Broadcast Studios. It is gratifying to find that the problem of Flutter Echo—which often occurs in Radio Studios—has been treated here satisfactorily for the first time.

There are many references to European authors in the bibliography but it is a little surprising to note that there are no references to the work in U.S.A. after 1940.

The author's objective is ostensibly "to give Civil Engineers and architects some idea of the laws of acoustics", but much of the material seems too specialised to be of much use to the practising architect. However, the mass of experimental data one finds in this book will be invaluable to the research scholar and the acoustical engineer actively interested in the design of acoustically perfect buildings.

RAM K. VEPA.

Elementary Calculus. By M. Lakshmanamurti (Rao Brothers, Guntur). Pp. xxii + 207. Price Rs. 2-8-0.

This book is particularly well written for beginners. It combines a masterly and lucid exposition of the subject along with the necessary rigour appropriate for this stage. The first chapters dealing with functions, limits, continuity and differential co-efficient can be recommended even to students of B.A. and B.Sc. classes.

The illustrative examples are extremely well chosen and indicate that the author is a teacher of ripe experience of University classes. The question papers at the end of the book also serve a very useful purpose. As a text-book for the Intermediate, this is perhaps easily the best book now available either from the point of view of the student or the teacher.

B. S. MADHAVA RAO.

Fault Calculations. By C. H. W. Lackey. (Published by Oliver & Boyd, Ltd.), 1951. Pp. xi + 296. Price 30 *sh.* net.

The calculation of fault currents and voltages is of the utmost importance for the proper design and operation of electric power systems, and the subject forms a major part of what may be called "Power System Analysis". In the case of large and inter-connected systems, such calculations are nowadays made with ease and rapidity on D.C. calculating boards and A.C. network analyzers. However, an analyzer is not a substitute for brains and a thorough knowledge of the analytical methods of network solution is still essential to the power system designer.

Though several books have already been published on the subject of fault calculations (some of them have been mentioned in the bibliography) the author has tried to lay emphasis on the practical aspects of the subject. Chapters I to IV deal with the fundamentals of fault-calculations, *viz.*, the use of vectors, vector-algebra, impedance-notations, network reduction calculation of balanced faults, symmetrical components and calculation of unbalanced faults. Chapter V is devoted to the subject of the impedances of power system components and an appendix is added containing schedules of impedance-data of generators, transformers, overhead lines and cables for systems operating on 50 cycles. Though such data are easily available for 60 cycle systems in American technical literature, some amount of

difficulty has been felt by power system engineers operating on 50 cycle systems, owing to lack of information on the impedances of power system components. The appendices are therefore most welcome. In Chapter VI a variety of practical problems of power system performance under fault conditions are considered. The book concludes with a chapter on fault-calculators and network-analyzers which are so invaluable for solving power system problems. Brief descriptions of the Universal fault-calculator and the Dual-circuit fault-calculator (Reyrolle), the A.C. network analyzer (Associated Electrical Industries) and the Blackburn network analyzer (Merz and McLellan) all of British make, are included.

There is no doubt that the book would be of immense help both to students and power system engineers; however, one gets a feeling that the book has been written to fill a gap in British technical literature.

The printing and get-up of the book are good but the price seems to be rather on the high side.

H. N. RAMACHANDRA RAO.

The Intelligent Use of the Microscope. By C. W. Oliver. Second Edition. (Chapman & Hall Ltd., London, W.C. 2), 1951. Pp. xii + 192. Price 15 *sh.* net.

Since the first edition of this widely consulted and popular volume was published in 1947, there have been few advances in microscopical technique except for the one revolutionary development pertaining to Phase Contrast Microscopy. This far-reaching contribution to microscopy has been clearly and comprehensively covered by the last and the twelfth chapter of the volume. Those interested in a more detailed understanding of the theory and applications of phase contrast microscopy, will find the bibliography given at the end of this chapter, useful.

The present volume consists of 12 chapters, and practically follows the same plan which distinguishes the earlier edition. Reference is made to the reflecting microscope which is under development but no details are given in view of the circumstance that the instrument is not yet easily available. In a future edition, which we hope, will soon be issued, we have no doubt that an equally illuminating description of this new instrument will be included.

Written by one whose long and uninterrupted experience with a microscope commenced at the young age of seven years, the author is exceptionally qualified to appreciate the "problems, queries and difficulties" which confront a beginner and to clarify them with sympathy and understanding. This is a volume indispensable to every one interested not only in getting the best out of his instrument but also in maintaining it in an efficient working condition.

Annual Reviews of Biochemistry. Vol. XIX. Edited by J. M. Luck, H. S. Loring and G. Mackinney. (Annual Reviews Inc. Stanford University), 1950. Pp. xi + 596. Price $ 6.00.

The nineteenth volume of the now familiar and eagerly welcomed series of Annual Reviews of Biochemistry, possesses the usual features which characterise the series. With the inauguration and development of other series of Reviews on Plant Physiology and Microbiology, discussions of many topics of biochemical significance formerly covered by Biochemical Reviews, are being transferred to the new series of volumes. This step has been found both necessary and appropriate in view of the ever-increasing output of work and the rapid expansion and specialisation in the field of biochemistry.

The present volume covers 22 topics; they include Biological Oxidation by V. R. Potter, Proteolytic Enzymes by M. Laskowski, Non-oxidative, Non-proteolytic Enzymes by P. P. Cohen and R. W. McGilvery, Carbohydrate Chemistry by M. L. Wolfrom and J. M. Sugihara, Chemistry of Lipids by H. J. Deuel Jr., Chemistry and Metabolism of the Steroid Hormones by G. Pincus, Chemistry of Amino-acids and Proteins by R. K. Cannan and M. Levy, Nucleic Acids, Purines and Pyrimidines by G. Schmidt, Carbohydrate Metabolism by S. Ratner and E. Racker, Fat Metabolism by G. Medes, Metabolism of Proteins and Amino-acids, by P. P. Swanson and H. E. Clark, Chemistry of the Hormones, by A. White, Water-soluble Vitamins, by E. E. Snell and L. D. Wright, Fat-soluble Vitamins, by T. Moore, Nutrition, by H. M. Sinclair, Muscle, by F. B. Straub, Biochemistry of Neoplastic Tissue, by C. Carruthers, Chemical Composition of Blood Plasma and Serum, by H. A. Krebs, Pyrrole Pigments, by R. Lemberg and J. W. Legge, Immunochemistry by P. Grabar, Biochemistry of Antibiotics, by H. E. Carter and J. H. Ford. The subject of Partition Chromatography whose application to the biochemical problems has spectacularly influenced and facilitated the progress of biochemical research, has been reviewed by A. J. P. Martin.

Extensively supported by references to literature and comprehensively documented with author and subject indices, the volume constitutes an indispensable reference book to investigators in biochemistry.

Bacterial Physiology. Edited by C. H. Werkman and P. W. Wilson. (Academic Press Inc., New York), 1951. Pp. 707. Price $ 8.50.

Here is a fascinating book on bacterial physiology, for advanced students and research workers engaged in the bewildering and rapidly advancing field of biochemistry. The book has been edited by two well-known investigators in the field of microbial physiology and comprises 20 essays on different aspects of the chemistry and physiology of micro-organisms written by reputed workers in the different fields. Knaysi has written on the structure and chemistry of the bacterial cells; Lederberg on inheritance variation and adaptation; Gunsalus, Mitchell and Wyss on the growth and death of bacteria; Snell on bacterial nutrition; Schlenk on bacterial enzymes; Werkman and Schlenk on anaerobic dissimilation of carbohydrates and Barron on bacterial oxidations. The subjects of assimilation of carbon dioxide and nitrogen by different groups of bacteria, mineral metabolism and hydrogen metabolism have been dealt with by authors like Foster, Werkman, Gale, Wilson, Knight and Koffler who have themselves contributed much to the development of knowledge in these fields. There are four chapters devoted to the discussion of some of the latest concepts regarding the assimilative and synthetic activities of micro-organisms, the biological significance of autotrophy and luminiscence of bacteria, etc., etc., and written by Koffler and Wilson, Clifton, Barker and Hassid, Umbreit and Johnson. All the contributors have written in a very illuminating and thought-provoking manner and even if one may not be in entire agreement with some of their views they merit the serious consideration of all readers. Thus instead of a mere compilation of the huge amount of work in the various fields of bacteriophysiology, there has been a judicious sifting of the results and a presentation of the most significant findings so that the post-graduate student and the research worker may get some concrete picture out of the mass of confusing data. There is also a bibliography with which is combined an author index, a subject index, and a micro-organism index. The book is profusely illustrated with graphs, photographs and electron micrographs. The get-up and printing of the book are excellent. It may safely be recommended as a "must" for the shelf of the research worker, teacher and post-graduate student in bacteriology.

K. K. IYA.

Pharmacopoeia Internationalis Edito Prima, Vol. I. (International Pharmacopœia, First Edition, Vol. I), W.H.O. Supplement 2, 1951. Pp. xviii + 406. Price 35 *sh.*

It is gratifying to note that the attempts to achieve the unification of terminology and standardisation of drugs, started as long back as 1874, has yielded the desired result in the publication of this volume by W.H.O. under the ægis of United Nations. One cannot lay too much emphasis on the desirability of establishing an international agreement on matters concerning the standards of safety, purity and potency of biological and pharmaceutical products which are of vital importance both to the medical profession and the general public.

In form and general arrangement this pharmacopœia follows the practice of present-day national pharmacopœias. Monographs together with the appendices form an authoritative source for specification of drugs and preparations, biological assays and chemical methods.

This work, accomplished by international collaboration is sure to be adopted by the various countries and result in "promoting and protecting the health of all peoples".

M. SIRSI.

A Text-Book of Plant Physiology. By P. L. Kochhar. (Atma Ram & Sons, Delhi), 1951. Pp. x + 316. Price Rs. 10.

This book on Plant Physiology is intended to meet the requirements of students preparing for a Degree in Botany or Agriculture. Its eighteen chapters are devoted to a comprehensive treatment of the various aspects of the functioning of the living plant. In a field where a mass of literature has accumulated in recent years and where many controversial problems exist, it is not to be expected that, in a book of this kind, there should be any detailed discussion of them. The author has, however, tried to indicate the trend of modern views in the explanation of various plant functions like the absorption of water and dissolved substances, translocation, etc. The role of trace elements and hormones in the growth of the plant, the problems of drought and frost resistance, vernalisation, all of which find application in agricultural practice, are also referred to in the

text. A welcome feature of the book is the inclusion at the end of each chapter of a set of simple experiments which could conveniently be carried out in the class room. The experimental aspect is often not given the importance it deserves. An appendix gives a series of test questions selected from various University examinations. Barring a few misprints here and there, the printing and general get-up of the book can be considered to be quite satisfactory and the book is one which could profitably be used by the B.Sc. students of our Universities.

M. A. R.

Elsevier's Encyclopaedia of Organic Chemistry. Edited by F. Radt. Series III. Carbocyclic Condensed Compounds, Vol. 14, Supplement. Tetracyclic and Higher Cyclic Compounds except Steroids and Triterpenes. Elsevier Publishing Co., Amsterdam, 1951. Pp. 1 S-938 S. Price not given.

Vol. 14 of Elsevier's Encyclopædia, which appeared in 1940, consisted of 711 pages and covered the literature on carbocyclic compounds containing four or more rings, including the steroids. Work on compounds of these types, especially from the point of view of their carcinogenic and other physiological properties, has been proceeding on such an extensive scale that a supplement in two volumes has become necessary to deal with the literature during the decade 1936-46. In these ten years, not only has our knowledge of the known ring systems undergone considerable expansion, but compounds belonging to as many as 145 new ring systems have also been synthesized. The volume under review is Part I, and it excludes the steroids and triterpenes, which are to be treated in a subsequent volume as Vol. 14, Supplement, Part II. The number of pages devoted to 1 : 2-benzanthracene, cholanthrene and 3 : 4-benzpyrene has increased from 14 to 130, from 2 to 37, and from 2 to 64, indicating the extent of the literature on these and similar carcinogenic compounds which has appeared between 1936 and 1946. Patent literature, excluded from the Main Volume, is covered in the Supplement. The criticism made in an earlier review (*Current Science*, 1950, 19, 329) regarding this separation of patent and other literature has been largely invalidated, and the usefulness of Elsevier's Encyclopædia greatly increased, by the appearance of supplements embracing patents. An important feature of the Supplement to Vol. 14, which will also be found in the supplements to other volumes, is that the survey of the methods of formation of each ring system, occurrence of compounds in nature, summaries of the ring systems, the summarized data on compounds, and the subject and formula indices consolidate the main and supplementary volumes. Thus a reference to the Supplement is adequate for tracing all the literature up to 1946 on a given compound or ring system.

No chemical library can afford to do without Elsevier's Encyclopædia. It is to be hoped that the main volumes of the entire series will be completed during the next few years and that decennial supplements will continue to be published at regular intervals.

K. V.

Nomographic Charts. By C. Albert Kulmann. (McGraw-Hill), Pp. 244. Price $ 6.5.

Nomograms are well known for the ease of operation in solving both scientific and technical problems within the shortest period of time. There are a number of books which deal with nomograms but they confine themselves to some particular subject. The book under review is more of a general nature and covers a much wider field for the scientist as well as the engineer, and will be found very useful in the design office where a lot of calculations are involved.

The book is divided into six sections. The first two deal with general mathematical formulæ, like the determination of roots, powers of numbers, areas of circles, reciprocals and reciprocal sums, etc. Chapter III is concerned with hydraulic charts which are very useful for determining the velocity against head, conversion of water-pressure, discharge over weir under varying conditions, flow in pipes and open channels, etc. The charts relating to turbine and pumps and rainfall intensity and run-off are very interesting and useful. Chapters IV, V deal with problems commonly met with in mechanics and thermodynamics. The last chapter contains charts for use in electrical engineering problems whose solution is considerably facilitated with the help of these charts.

The book gives clear and detailed instructions regarding the use of each chart, though the mathematical background is not given. These charts are very useful where slide rule methods cannot be used readily. The get-up and printing are quite attractive. The book should find a place in all technical and scientific libraries.

K. SEETHARAMIAH.

SCIENCE NOTES AND NEWS

Symposium on the Rajputana Desert

The National Institute of Sciences of India are holding a Symposium on "The Rajputana Desert" in Delhi on 7th, 8th and 9th March, 1952. The Symposium will deal with all aspects of desert science, climate, soil, water, solar energy, biology, etc. The subject is of great national importance and invitations have been issued to all interested Governments and specialists. Any person not invited by name will be most welcome if he takes part in the Symposium or sends papers to the Convener: Dr. S. K. Banerji, D.Sc., F.N.I., College of Engineering and Technology, Bengal; Jadavpur, Calcutta 32. Papers on specified subjects will be received for a short time after the Symposium for inclusion in a Bulletin to be issued by the National Institute.

Symposium on Paints and Varnishes

A Symposium on Paints and Varnishes will be held under the auspices of the National Chemical Laboratory of India, on March 6 and 7, 1952. It is proposed to divide the Symposium into the following broad sections: (1) Raw materials for varnishes; drying and treated oils, resins, driers, solvents and thinners. (2) Pigments, metallic powders and metallic soaps. (3) Manufacture and testing. (4) Recent developments and special purpose coatings. Those intending to take part are requested to communicate with Shri. K. K. Sarin, National Chemical Laboratory, Poona 7.

Assistance from Ford Foundation

Under the agreement now signed between the Government of India and the Ford Foundation, the latter will assist in financing, partly, the first five training centres for rural extension service and the 15 intensive development areas which are to be set up. In general, the financing of the intensive development areas will be done by the Government of India and the States. To the extent, however, that such assistance can accelerate the initiation of development work, the Ford Foundation will provide the finance.

The Foundation will also consider (*a*) the furnishing of financial assistance to sound extension training programmes at a few carefully selected higher educational institutions, and (*b*) the furnishing of assistance to the Government of India and the States in evaluating various efforts now under way or planned.

Synthesis of Diamonds

Significant progress in the production of synthetic diamonds was reported at the Twelfth International Congress of Pure and Applied Chemistry by Dr. William O. Baker and Dr. Field H. Winslow of the Bell Telephone Laboratoris. Hard spheres of carbon which will scratch glass surfaces have been made by subjecting the chemical polydivinyl benzene to very high temperatures. The new form of carbon is somewhere between graphite and real diamonds. Because of their great purity and uniformity, the spheres can be used in making carbon rods in atomic piles. The hardness and abrasive quality of powdered polymer carbon suggests its use in grinding and polishing operations, and in replacing diamond dust in some cases. The carbon pellets are also semi-conductors and may find many uses in modern electronic equipment. The diameter of the carbon sphere varies from as little as one-millionth of an inch to about one-sixteenth of an inch.

Bombay Veterinary College—Diamond Jubilee

The Diamond Jubilee Celebrations of the Institution were celebrated on 25th December, 1951, when Dr. S. Datta, Director, Indian Veterinary Research Institute, presided. In the course of his presidential address Dr. Datta emphasised that veterinary education should no longer be on the old stereotyped system of concentrating on diseases and parasites, but should be on the normal physiological aspect of health and productivity. It must be realised that the animal is a complex biological entity which results from its own heredity and factors of management like nutrition and environmental conditions. The best account can be given by an animal only by the co-ordinated function of all its organs and tissues and by a proper adjustment to factors characterising each environment.

Plastic Lenses Inside the Eye

A report from a British eye specialist in a recent issue of *Lancet* says that a lens in plastic

material can be inserted into the eye in place of the diseased lens at the time of the extraction or at a second operation. The new lens is, of course, not a copy of the human lens, nor can it replace entirely the delicate adaptable structure which normally serves for focusing purposes, but it is reported to work in a way that "closely and consistently reproduces the normal". Twenty-five eyes have been operated upon with the insertion of a plastic lens. The first two cases were unsatisfactory and of the remaining 23, one gave trouble. It is thought that the new lens can remain in an eye for at least two years without causing irritation.

Training in Quality Control

An agreement has recently been signed by the Government of India with the United Nations Technical Assistance Administration for training in Statistical Quality Control. Under this agreement U.N. Technical Assistance Administration will provide the services of a Director and three expert Lecturers for a period of three months and an Executive Secretary for a period of four months. The Government of India have agreed on their part to meet the local expenses of the experts to the extent of Rs. 50,000. This scheme is being sponsored by the Central Statistical Organisation under the Cabinet Secretariat of the Government of India. They will arrange for the attendance of 25-30 suitable students at each such training centre organised during the period.

Scientific Material Purchases with UNESCO Coupons

Orders to the U.K. should be addressed to: The Scientific Instrument Manufacturers' Association of Great Britain, Ltd., 20, Queen Anne Street, London W 1.

Enquiries for sources of supply in the U.S.A. of radio parts and accessories and of electronic equipment may be addressed to: The National Appliance and Radio Dealers' Association, Merchandise Mart, Chicago 54, Illinois, U.S.A. These organisations will then designate a suitable dealer for each enquiry.

British Commonwealth Collections of Micro-Organisms

A Directory of collections of micro-organisms maintained in the British Commonwealth and a list of species obtainable from them has been published by H. M. S. O. (Price 5 *sh.*; by Post 5 *sh.* 3 d.). Details of 91 collections are given, with the types of organisms held and whether they can be obtained on request, on payment of a fee, or as a personal favour.

The list of species is divided into sections corresponding to the different branches of micro-biology and includes algæ and protozoa, bacteria, fungi, viruses and bacteriophages and yeasts. Opposite each species name there are the code numbers of collections maintaining the organism, from which full particulars can be found.

Journal of Scientific and Industrial Research

With the issue of the January 1952 Number, the J. S. I. R. published by the Council of Scientific and Industrial Research (Ministry of Natural Resources and Scientific Research, Government of India), enters the 11th year of its publication. Since its first appearance as a quarterly in 1942, the progress of the Journal has been continuous, *pari-passu* with the expansion of the activities of the Council. In view of the increasing number of scientific articles received for publication, the Editorial Board have decided to increase the number of pages per issue of the Journal. Our heartiest good wishes for the future progress of the Journal.

Award of Research Degree

On the recommendation of Boards of Examiners consisting of Professors Sir E. K. Rideal, A. J. Allmand, Sir S. S. Bhatnagar and S. S. Joshi, and of Professors W. E. Garner, Sir J. L. Simonsen and K. Banerji, the Degree of Ph.D. of the Banaras University was conferred on Messrs. K. Seshadri and S. M. Deshpande, for theses entitled, "Electro-Chemical Preparation of Hydrogen Peroxide" and "Production of Joshi Effect in CO, CO_2 and Organic Vapours".

The University of Poona has awarded the Degree of Doctor of Philosophy in Agriculture to Mr. S. L. Manjarekar for his thesis entitled "Rickettsiosis in Sheep and Goats in the State of Bombay".

ADDENDUM

Vol. 21, No. 1, p. 10: In the note on 'Estimation of Phenolphthalein', *read* sodium bicarbonate (saturated solution) *for* sodium bicarbonate.

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